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VITAL SIGNS
2002–2003

The Trends That Are Shaping Our Future

BPO

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As we strive to make each edition of *Vital Signs* more useful than the last, we thank you, our readers From educators and reporters to government officials and concerned citizens, many of you have taken the time to tell us how you are using this book to make a difference in the world A lecturer at Florida State University is mining *Vital Signs* for an "Environmental Minute" TV show On the other side of the world, the Director of the Global Environment Program at Vietnam National University has sent copies of the Vietnamese edition to senior government officials An editor of a weekly publication in Latin America says she uses *Vital Signs* as a primary resource, "alongside my Webster's dictionary, AP style book, and *New York Times Almanac* " And to keep colleagues informed of crucial global trends, a Scottish parliamentarian asked the Parliament's library to order *Vital Signs*

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This is the second edition we have produced in cooperation with the U N Environment Programme (UNEP) We appreciate in particu-

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The in-house people and talents that Worldwatch draws on to produce *Vital Signs* are as varied as the indicators in this book. This year, the Project Team consisted of Michael Renner (Project Director), Brian Halweil, and Molly O'Meara Sheehan. As we prepared this edition, crucial support was provided by Institute stalwarts Barbara Fallin and Suzanne Clift, our business and development team of Adrianne Greenlees, Elizabeth Nolan, Kevin Parker, Mary Redfern, and Cyndi Cramer, and our communications team of Dick Bell, Leanne Mitchell, Patrick Settle, Sharon Lapier, Niki Clark, and Susanne Martikke. For the hardest-to-find reports and data sets, authors rely on our research librarian Lori Brown, assisted by Jonathan Guzman, and on Joseph Gravely in our mailroom.

This year, our regular research staff was bolstered by a network of Worldwatch alumni: Ann Hwang, Janet Larsen, Nick Lenssen, and Mike Scholand. While not full-time staffers, Worldwatch Board Member Lester Brown and Senior Fellow Sandra Postel, assisted by Katie Blake, also made key contributions. An especially talented crew of interns, including Jessica Dodson, Kathleen Hluvane, and Uta Saoshiro, found time to draft pieces of their own while assisting senior researchers, as did Erik Assadourian, who has since come on board as a full-time researcher. Arriving late in December, our newest intern, Meghan Cummins, pitched in during crunch time.

Finally, we thank two individuals at the core of this book. Independent editor Linda Starke held authors' feet to the fire, turning dozens of drafts submitted by 23 nearby and far-flung authors into polished prose at breakneck speed. Working under the most intense deadline pressure, Art Director Elizabeth Doherty maintained her creative spark to make *Vital Signs* both better-looking and easier to understand. Several of the photos Liz selected for this edition are from Photoshare, the online photo database of the Media/Materials Clearinghouse at the Johns Hopkins University Population Information Program at <www.jhuccp.org/mmc>. We are sad to note that this is Liz's final *Vital Signs*. Since September 1996 Liz has brought considerable talents and an untiring spirit to six editions of this book. We wish her well in her new endeavors.

Vital Signs Project Team
March 2002

Worldwatch Institute
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PREFACE

By most standards, including many of the "vital signs" catalogued in this book, the past year would be classified as an *annus horribilis* A year that began with economic recession and heavily publicized food safety scares was later marked by violent outbreaks of ethnic conflict and the most deadly single episode of terrorism the world has ever seen

Hopes that the world had entered a period of peace and prosperity at the dawn of the twenty-first century had to be put aside as the year proceeded, amid growing awareness of the instabilities inherent in a period of accelerating change—and the web of interconnections that make people everywhere vulnerable to crises that break out anywhere

Vital Signs 2002 focuses not on the spectacular events that dominated news coverage of the past year but on the deeper, more chronic trends that define the health of people and the planet—and that provide the context for the crises that command public attention These trends now point to a dangerous instability, one that can only be righted by concerted efforts to create a more secure and sustainable world

The fact that 1 2 billion people live on less than $1 a day—a figure roughly unchanged even after a decade of phenomenal economic growth in much of the developing world—is clearly undermining stability in some societies And rapid economic growth has created a rising gap between rich and poor in many countries, another force of instability

So long as 3 million people die yearly from AIDS, 100–150 million suffer from asthma, and 2 4 billion lack basic sanitation—all documented in the pages that follow—it is hard to imagine that we can achieve a stable or secure world

Growing instability is seen in the natural world as well The year 2001 was the second warmest on record, joining a list of the 10 warmest years in the last century—all of which have occurred since 1990 Carbon dioxide, the leading greenhouse gas, continues to build up in the atmosphere as carbon emissions reached a new high

On the ground, an estimated 150–300 million hectares of cropland—10–20 percent of the world total—is now degraded More than 2 billion people live in water-stressed countries in which water supplies are insufficient to meet food, industrial, and household needs

When world leaders gather at the World Summit on Sustainable Development in Johannesburg, South Africa, they will face no shortage of challenges Indeed, the need for a global action plan on the interlinked problems of environmental decline and human poverty has never been as evident as it is this year

While the problems facing the world in Johannesburg are daunting, *Vital Signs 2002* also offers encouraging evidence that national policy and even human behavior can change in response to new threats—and that sometimes solutions emerge that no one would have expected

Who would have guessed a decade ago, for example, that the world leader in producing the efficient compact fluorescent light bulbs pioneered in Europe and the United States would be China? Or that wind power would become the world's fastest-growing energy source—with annual additions to generating capacity on the verge of overtaking hydropower? And who would have imagined that the fastest-growing transportation trend in industrial countries would be car *sharing*, an alternative to private ownership that reduces the temptation to overuse the automobile?

As these few examples suggest, change can sometimes happen quickly, and it is most effective when it involves both the innovative capacities of private citizens and companies and the societal goals and incentives that are the province of governments and international agencies. The Johannesburg Summit offers an opportunity to move forward with implementation of agreements now in place, pursuing strategies that will provide economic opportunities at the same time that they solve environmental problems.

The Worldwatch Institute and the United Nations Environment Programme are both convinced that change is possible—and that an informed public is the first ingredient of productive change. We hope that *Vital Signs 2002* will provide some of the information that people and their leaders need to make wise decisions.

Christopher Flavin
President
Worldwatch Institute

Klaus Topfer
Executive Director
United Nations Environment Programme

VITAL SIGNS
2002–2003

TECHNICAL NOTE

Units of measure throughout this book are metric unless common usage dictates otherwise Historical population data used in per capita calculations are from the Center for International Research at the U S Bureau of the Census Historical data series in *Vital Signs* are updated each year, incorporating any revisions by originating organizations

Data expressed in U S dollars have for the most part been deflated to 2000 terms In some cases, the original data source provided the numbers in deflated terms or supplied an appropriate deflator, as with gross world product data Where this did not happen, the U S implicit gross national product (GNP) deflator from the U S Department of Commerce was used to represent price trends in real terms

OVERVIEW

Making the Connections

Michael Renner

In the aftermath of 11 September 2001, many people have said that the terror attacks changed the world in fundamental ways. It may be more appropriate to say that the shocking events of that day were a dramatic wake-up call—a catalyst for undertaking a critical reassessment of the state of affairs on our globe, and of the underlying conditions that feed desperation, fuel resentment, and breed violence. A candid appraisal reveals widening disparities between rich and poor, mounting health challenges, battered ecosystems, and persistent social and political conflicts. Yet there are also many opportunities for positive change through the promotion of social justice and environmental health, international cooperation, technological innovation, and greater prudence in the pursuit of human ingenuity. Many of those topics will be addressed in Johannesburg in August–September at the World Summit on Sustainable Development—an ideal time to capitalize on the opportunities for change.

Vital Signs 2002 offers information on a broad range of issues critical to putting the world on a more just, ecologically resilient, and ultimately peaceful trajectory. It brings together a careful selection of topics, seen through the lens of global equity and sustainability. As in previous editions, *Vital Signs* covers a range of basic and long-established indicators such as gross economic product and trade flows, population growth, grain production, fossil fuel consumption, automobile manufacturing, and roundwood production. And it continues to document alternative indicators of ever-growing significance, like wind and solar power development, bicycle production, carbon emissions, chlorofluorocarbon (CFC) use, and the growth of biotechnology.

But in recognition of the many issues critical to sustainability, new topics are also covered in *Vital Signs 2002*. Roughly one third of the book addresses issues not covered earlier, including sugar crops, soft drink consumption, oil spills, hazardous waste trade, ecolabeling, appliance efficiency standards, car-sharing, urban sprawl, asthma, mental health, the cruise industry, transboundary parks, teacher shortages, and gender-based violence.

Among the most promising developments documented in *Vital Signs 2002* are the surging sales of efficient compact fluorescent lamps (CFLs, with an estimated 1.8 billion in use worldwide), the continued rapid expansion of wind and solar-generated electricity, the steady decline in the amount of oil spilled accidentally, and the ongoing reduction in production of ozone-destroying chemicals. Other encouraging developments are the decreasing metals intensity of the world economy, the growing reliance on transboundary parks as tools for biodiversity conservation and peace- and confidence-building, the expansion of commercial forest areas that have been certified as well-managed, reductions in the number of active armed conflicts, and progress in curtailing reliance on landmines.

On the downside, there is ongoing forest loss in the tropics, the threat of extinction for many freshwater species, the relentless generation of huge amounts of hazardous waste, the continued expansion of the car-centered transportation system, the massive spread of HIV infections, runaway consumption of sugar and soft drinks, widespread teacher shortages, an epidemic of violence against women, and declining foreign aid.

The impacts of some of the trends documented in *Vital Signs* are self-evident. Others may be less clear-cut. For instance, there is nothing intrinsically wrong with increased cocoa production, but reports of children being forced to work in slavery-like conditions in some areas add a negative tint to this trend. Most economists regard growing car production as a positive development because of job creation and enhanced mobility. But the rising costs of a car-centered transportation system—from air pollution and carbon emissions to urban sprawl and the fatalities and injuries from traffic accidents—suggest a more negative assessment.

Qualitative assessments of Earth's vital signs are of necessity subjective in nature, the result of different sets of values, philosophies, expectations, and goals. The proverbial glass can be seen as half full or half empty. Readers may draw their own conclusions.

CONNECTIONS

Although each individual item in this book was written as a stand-alone piece, the intention is to encourage readers to engage in cross-cutting comparisons among related issues. The contents of this year's *Vital Signs* can be grouped in a variety of topic clusters. This overview looks at three such clusters—energy, climate, and transportation, land, water, and food, and the impact of technology. These are only some of many cross-cutting issues to emerge. Readers might want to do their own comparisons of material in this book and draw linkages and conclusions that are germane to their work and interests.

Due to expanding trade, travel, and communications networks, the world has become ever more interlinked, so that events in far-flung places affect millions elsewhere on the planet. This is as true for economic and political issues as for social and environmental ones.

Other connections are equally crucial and yet too often remain unacknowledged. When millions of motorists turn on their cars in the morning on their way to work, they may not be aware that the simple act of driving is contributing to the unraveling of the climate system, thus helping to cause or worsen floods in Bangladesh, mudslides in Central America, or droughts in parts of Africa. At the furniture store, consumers may buy products made from wood harvested in destructive logging operations that threaten the livelihoods of indigenous populations. As these two simple examples illustrate, no society lives in isolation in this interlinked world. Oceans and other natural barriers are no longer insurmountable. Borders are far from impermeable. The challenge in a world of nation states of different size and power is to devise ways to maximize the benefits and minimize the damage from the globalization now being experienced.

ENERGY, CLIMATE, AND TRANSPORTATION

An understanding of the manifold and complex connections that characterize the modern world is increasingly critical. Energy plays a particularly important role. The global economy has long depended on the availability of abundant supplies of cheap energy, particularly from the politically volatile Persian Gulf region. Maintaining access to oil at all cost has been a central tenet of economic and military policies of western industrial countries. But this policy has contributed to repeated upheavals in the Middle East. The energy status quo not only implies continued instability for the world economy and for world peace, it also has grim consequences for the stability of the global atmosphere. (See Figure 1.)

Fossil fuel consumption and carbon emissions each rose more than 1 percent in 2001, reaching new peaks. (See pages 38–39 and 52–53.) Global temperatures have been on the

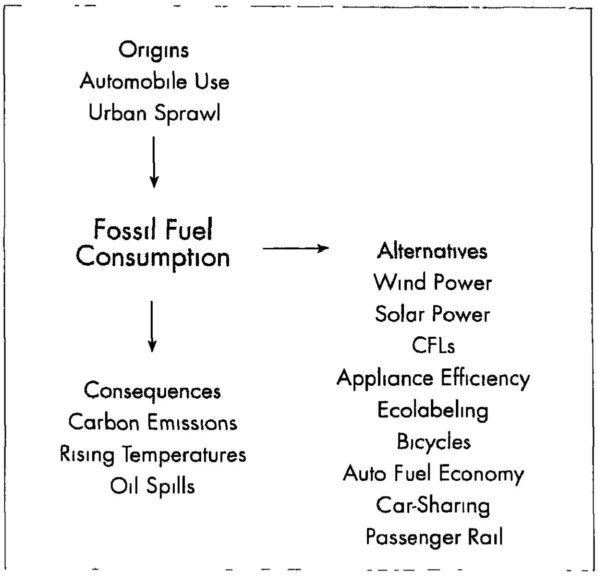


Figure 1 Energy, Climate, and Transportation Connections

upswing during the past half-century, and land and ocean measurements show that 2001 was the second-warmest year on record since the late nineteenth century. Not surprisingly, 2001 brought several episodes of abnormal weather, including an above-average number of hurricanes and tropical storms in the north Atlantic basin, severe flooding in Viet Nam, Siberia, and different parts of Africa, and devastating droughts in Iran, Afghanistan, Pakistan, the Horn of Africa, Brazil, northern China, North Korea, and Japan. (See pages 50–51.)

To quench the industrial world's thirst for fossil fuels, tankers transport some 107 million tons of oil each day. Oil tankers are a leading source of oil spills, though pipelines, production wells, storage facilities, and refineries are important sources as well. The good news is that a variety of safety measures have helped reduce oil spills from civilian operations. The amount of oil lost in 2000, almost 50,000 tons, was the lowest since continuous recordkeeping began in 1968. Still, even small amounts of oil can do major damage if an accident occurs in or near a fragile ecosystem. (See pages 68–69.)

Car-centered transportation is playing a major role in the world's voracious appetite for fossil fuels. This is particularly the case in sprawling urban areas where long travel distances render biking and public transport almost impossible while making reliance on cars a daily inevitability. During the 1990s, road transportation was the fastest-growing source of carbon emissions from fuel burning. There are now 555 million passenger vehicles on the world's roads, and factories churn out about 40 million new cars each year. (See pages 74–75.) Although car fuel economy is again improving after having stagnated for many years, it remains far short of technical possibilities. And in the United States, which has slightly more than a quarter of the world's cars, there is little prospect of significant improvement over the next decade. (See pages 152–53.)

Passenger-kilometers traveled by rail have stagnated since the late 1980s, and rail continues to lose out to travel by car and airplane. (See pages 78–79.) Meanwhile, global production of bicycles has recovered from a slump, topping 100 million units in 2000 for the first time since 1995. But the bicycle industry continues to struggle. (See pages 76–77.) Particularly in Europe, an alternative approach is rapidly gaining adherents. Car-sharing is attracting rising numbers of people who do not see a need to own a car themselves. Such ventures offer social and environmental benefits to cities. (See pages 150–51.)

Headway is being made in some other ways to reduce energy use. Compact fluorescent lamps are longer-lasting and far more energy-thrifty than conventional incandescent light bulbs. Sales of CFLs worldwide grew 15 percent in 2001 alone, and have increased more than 13-fold since 1988. (See pages 46–47.) Efficiency standards for domestic appliances have been initiated in 43 countries worldwide, and have helped eliminate more energy-thirsty models from the market. (See pages 132–33.) Consumers can make more responsible purchasing decisions by relying on ecolabeling that guides them toward more-efficient and environmentally benign goods and services (See pages 124–25)

Making more efficient use of fossil fuels is only part of the equation An equally important task is to promote alternative sources of energy Wind and solar power have been growing rapidly in recent years, and use of each expanded by more than 30 percent in 2001 alone (See pages 42–45)

LAND, WATER, AND FOOD

A number of critical connections also exist in the realm of food and agriculture Arable land and water for agriculture are among the most critical resources for human well-being and survival, no matter the technological prowess of a society Yet freshwater resources are often tapped beyond sustainable rates and many cropland areas are pushed to the limits Although the global grain harvest is near peak levels, farmers and consumers confront a number of serious quantitative and qualitative challenges (See Figure 2 and pages 26–27)

An estimated 10–20 percent of the world's 1 5 billion hectares of cropland are degraded to some degree, the result of excessive tillage and fertilizer use, inappropriate land use, removal of vegetation, and overgrazing In the developing world, the pace of decline has accelerated during the past 50 years to the point where a quarter of the farmland suffers from degradation Worldwide, farmland degradation has reduced cumulative food production by an estimated 13 percent over the last half-century (See pages 102–03)

Urban expansion eats into prime agricultural land, particularly in the case of cities that are characterized by a pattern of sprawl For instance, although only 3 percent of the U S land surface is urbanized, the most productive soils are often developed first as cities expand In fact more than 1 million hectares of arable land in the United States are paved over each year In China the figure is 200 000 hectares (See pages 152–53)

Another common factor in farmland degradation is salinization—a buildup of salt that occurs when excess irrigation water evaporates Salinization can hurt yields and even force the abandonment of irrigated land Today about 20 percent of the worlds 274 million hectares of irrigated land are damaged in this way (See pages 34–35 and 102–03)

Improved irrigation efficiency could avoid these problems and raise farm yields but at the moment, inefficient methods are used on 90 percent of artificially watered fields Greater efficiency is also important because growing water shortages in Africa Asia and the Middle East are forcing an increasing number of countries to rely on grain imports By 2015 with rising water shortages and populations a projected 40 percent of humanity will live in water-stressed countries, putting increasing pressure on global grain supplies Making low cost, efficient irrigation available to poor farmers will be key to alleviating hunger and malnutrition (See pages 34–35 and 148–49)

More efficient water use is also essential to save many freshwater species from extinction and to preserve the valuable ecological services

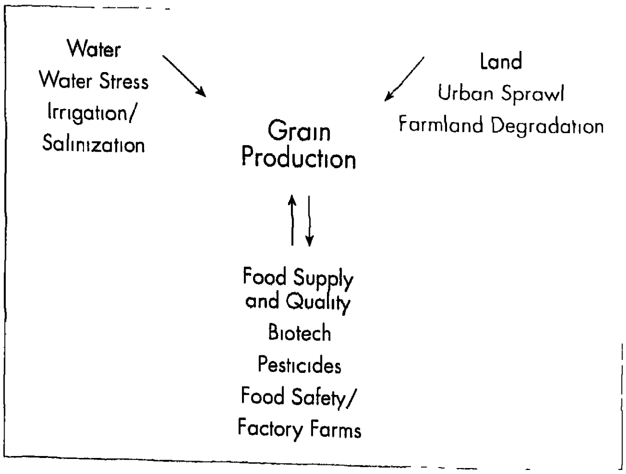


Figure 2 Land, Water, and Food Connections

they provide, such as filtering and cleansing water supplies and mitigating floods and droughts The habitat of these species is increasingly under assault by dams, river diversions, pollution, and the introduction of non-native species Almost 80 percent of the largest river systems in North America, Europe, and the former Soviet Union are moderately or strongly altered by dams, reservoirs, diversions, and irrigation systems, and similar challenges are now arising in the developing world (See pages 106–07)

Farming and other components of food production have become industrialized, resource-intensive systems On the input side, pesticide use (two thirds of it in agriculture) has grown 15-fold since 1950 but imposes a terrible toll, poisoning 3 million people severely and killing 220,000 each year Meanwhile, farmers confront increasing pesticide resistance (See pages 126–27)

For consumers, food quality ranks among the most widespread health concerns Food-borne diseases strike 30 percent of the population in industrial countries each year, but people living in developing countries bear a more frightful burden due to a wide range of hazards and inadequate prevention and treatment Though lack of household hygiene is a factor, many problems begin far earlier Livestock in many modern factory farms, for instance, are often raised in crowded, unsanitary conditions, which promotes food-borne illnesses (See pages 138–39)

THE HAZARDS OF HIGH-TECH AND OLD TECH

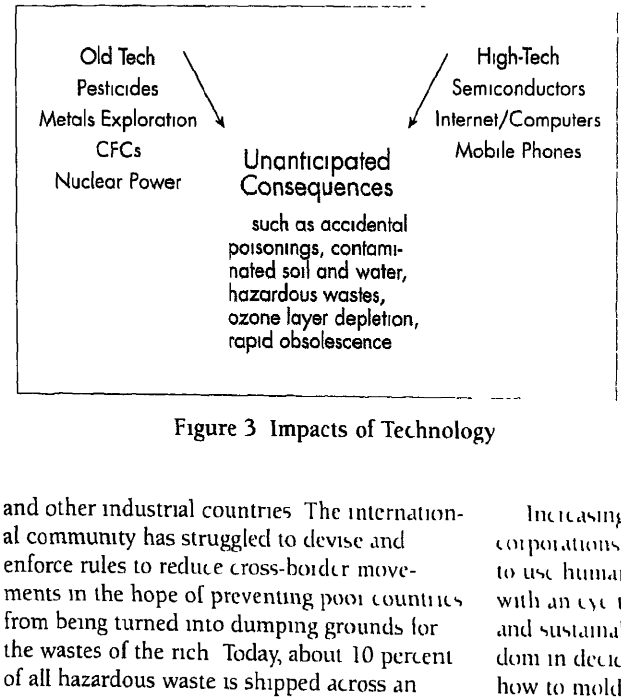
Humanity is confronting some of the broad boomerang effects of modern technology The unintended consequences of what once seemed technological marvels can entail severe threats to human health and well-being Nuclear power, at first considered too cheap to meter, is bequeathing the unwanted long-term "gift" of radioactive waste (See pages 40–41) Chlorofluorocarbons, for decades judged ideal for refrigerating, air-conditioning, and a host of other purposes, turned out to be efficient killers of the atmospheric ozone layer that protects life on Earth from deadly ultraviolet radiation Though CFC production is now down sharply, it may take a half-century for the ozone layer to heal completely (See pages 54–55)

Modern industrial life is characterized by the generation of substantial amounts of hazardous waste—both in traditional industries such as metals mining and processing, petrochemicals, pesticides, and plastics manufacturing and in newer, more high-tech sectors Some 300–500 million tons of heavy metals, solvents, toxic sludge, and other wastes accumulate each year (See Figure 3 and pages 66–67 and 112–13)

The semiconductor industry has undergone explosive growth in the past two decades In 2001, some 60 million transistors—the tiny components used to build semiconductor chips—were manufactured for each person in the world But because of the rapid pace at which electronic products become obsolete and are being replaced, production is expected to skyrocket in coming years, to perhaps as many as 1 billion transistors per person in 2010 Yet the industry requires copious amounts of chemicals and leaves behind huge quantities of dangerous wastes Production of a single six-inch silicon wafer results in 14 kilograms of solid waste and 11,000 liters of waste water Workers in the industry are on the frontline of exposure and at risk of developing cancer or seeing birth defects in their children (See pages 110–11)

Cell phones are among the products that incorporate semiconductors While they allow an ever more connected world and give millions of people access to phone service for the first time, discarded cell phones contribute to the growing mountain of electronics waste And there is an ongoing, unresolved discussion surrounding possible harm to human health from the radio waves they emit (See pages 84–85)

More than 80 percent of the world's hazardous waste is produced in the United States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Mobile Phones
Unanticipated Consequences
such as accidental poisonings, contaminated soil and water, hazardous wastes, ozone layer depletion, rapid obsolescence

Figure 3 Impacts of Technology

and other industrial countries The international community has struggled to devise and enforce rules to reduce cross-border movements in the hope of preventing poor countries from being turned into dumping grounds for the wastes of the rich Today, about 10 percent of all hazardous waste is shipped across an international border (See pages 112–13)

Though much hazardous waste trade takes place among industrial countries, there are some important exceptions The Basel Action Network, with support from other citizens' groups, found that huge quantities of computer monitors, cell phones, circuit boards, and other items from the United States end up in China, India, and Pakistan There, they are either being dumped or the materials they contain—lead, mercury, cadmium, copper, gold, and many others—are salvaged in such crude ways as to pose a severe occupational and environmental threat (See pages 82–83) Separated by thousands of kilometers, beneficiaries and victims of the high-tech revolution never meet face-to-face, but the connections between them are real

Time and again, technological innovation has kicked loose a range of unintended consequences Depending on the situation and the time an overly narrow focus of scientific inquiry excessive technological optimism unbridled reign of the profit motive or plain lack of foresight may lead societies to pursue technological promise with abandon only to discover surprising side effects unknown long term consequences and unanticipated feedback loops The world is still learning to cope with the repercussions of the chemical revolution even as it hurtles with great speed through the electronics age and plunges headlong into the biotech era

Increasingly, the challenge for scientists corporations, governments and individuals is to use human inventions more judiciously with an eye to the likely implications for equity and sustainability That requires greater wisdom in deciding what technologies to pursue how to mold them and when to look for alternatives Simply striving for the technically feasible is no longer a responsible option Indeed the precautionary principle—in the face of scientific uncertainty, exercise caution—becomes ever more important as our lives are increasingly permeated by the creations of human ingenuity and hubris This is possible only with a more holistic view of the world and a better understanding of the kinds of connections that this book explores

PART ONE

Key Indicators

Food and Agricultural Trends

GENE THIEMANN LUTHERAN WORLD RELIEF M/MC PHOTOSHARE WWW JHUCCP ORG/MMC

Aquaculture Production Intensifies
Grain Harvest Lagging Behind Demand
Meat Production Hits Another High
Cocoa Production Jumps
Sugar and Sweetener Use Grows
Irrigated Area Rises

Aquaculture Production Intensifies

Anne Platt McGinn

Global aquaculture production has grown nearly 400 percent in the past 15 years, from 7 million tons in 1984 (the first year with global data) to 33 3 million tons in 1999 [1] (See Figure 1) Preliminary data indicate production climbed to 36 1 million tons in 2000 [2]

Aquaculture is the fastest-growing segment of food production in the world [3] As global marine catches stagnate and even decline in some areas, aquaculture is quickly filling the gap It now provides 31 percent of the world's food fish, up from 19 percent in 1990 [4] Globally, the value of farmed fish doubled from $24 5 billion in 1990 to $47 9 billion in 1999 [5] (By comparison, fish catches were valued at $83 billion in 1998)[6]

Almost 9 out of 10 farmed fish in the world—some 86 percent—are now raised in Asia [7] Farmers in China boosted output by 252 percent during the 1990s, and now contribute 68 percent of the world's farmed fish by volume and nearly half of its value [8] (Unofficial reports indicate, however, that China has inflated its production data)[9] India is a distant second in terms of output, followed by Japan, Indonesia, and Bangladesh [10] By value, Japan, India, Indonesia, and Thailand round out the top five producers in the world [11]

Links
pp 106, 138

Chile posted the largest percentage gain in the last decade, with production jumping more than 700 percent—from 32,447 tons of fish in 1990 to 274,216 tons in 1999 [12] Farmed salmon and trout account for nearly 85 percent of Chile's output [13]

Some 220 fish species are now cultivated in captivity, although 20 species account for 90 percent of world production [14] From 1990 to 1999, world production of farmed carp, tilapia, and other freshwater fish nearly tripled, and now accounts for 56 percent of total output [15] (See Figure 2) These low-value species are generally raised and consumed locally

In contrast, high-end species such as shrimp and salmon are grown primarily for export to Japan, North America, and Europe Production of farmed shrimp and salmon roughly doubled during the 1990s, to just 8 percent of the total, but these two species now account for 24 percent of the value of world aquaculture [16]

The net trade earnings from captured and cultured fish in developing countries grew from $5 2 billion in 1985 to $15 billion in 1998 [17] Developing countries now earn more foreign exchange from exported fish products than from coffee tea rice and rubber exports combined [18]

Rapid growth in aquaculture has raised a number of concerns however Disease outbreaks have taken a stiff toll especially when high numbers of a single species are raised in small areas In 1999 Ecuador lost nearly $500 million in export earnings due to a catastrophic outbreak of white spot virus in farmed shrimp [19]

Another concern is aquaculture's growing appetite for wild fish Carnivorous fish such as salmon and shrimp are typically fed high protein pellets made from a combination of fish meal and plant-based proteins (Small pelagic species, such as anchovy herring and menhaden, are used to produce fishmeal) Today increasing numbers of farmers are replacing an entirely plant-based diet for omnivorous and herbivorous fish with feed pellets to induce faster growth and weight gain [20] As a result the share of world fishmeal dedicated to aquaculture has increased from 10 percent in 1988 to 35 percent in 1998 [21] During that time global fishmeal output remained steady while the share for poultry and cattle declined [22]

In contrast, marine-raised mollusks need few artificial inputs because they feed on nutrients from the surrounding water In 1999 cultured oysters and clams commanded 14 percent of the value of global aquaculture [23] Some experts are encouraging displaced fishers to adopt environmentally sound aquaculture to help generate income For example, farmers can cultivate species that fetch high prices on international markets, such as oysters for pearls and giant clams for the aquarium industry [24] But export-driven aquaculture does not eliminate the importance of raising fish for local consumption, a growing need in many food-deficit countries

Aquaculture Production Intensifies

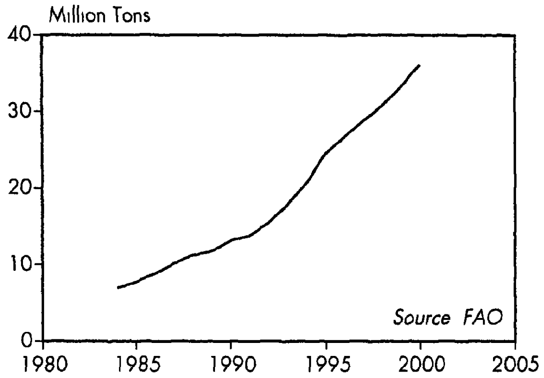


Figure 1 World Aquaculture Production, 1984–2000

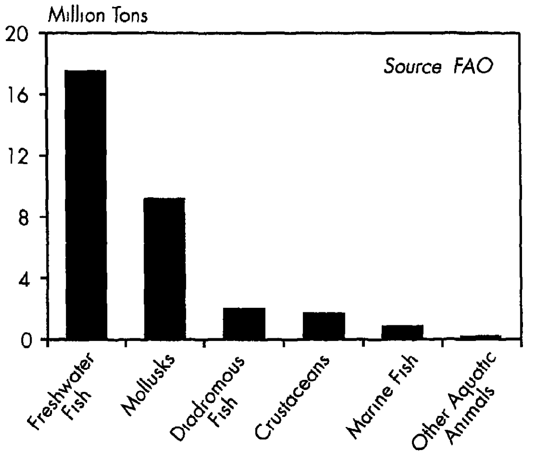


Figure 2 World Aquaculture Production by Major Species Groups, 1998

World Aquaculture Production, 1984–2000

Year	Production (million tons)
1984	6 9
1985	7 7
1986	8 8
1987	10 1
1988	11 2
1989	11 7
1990	13 1
1991	13 7
1992	15 4
1993	17 8
1994	20 8
1995	24 5
1996	26 8
1997	28 7
1998	30 8
1999	33 3
2000 (prel)	36 1

Source FAO, *Aquaculture Production Statistics 1984–93* and *Fishery Statistics Aquaculture Production*

Grain Harvest Lagging Behind Demand

Lester R. Brown

This year's world grain harvest, estimated at 1,843 million tons, is up slightly from last year's poor harvest of 1,836 million tons.[1] (See Figure 1.) It is, nonetheless, a depressed harvest—40 million tons below 1997's record 1,880 million tons.[2]

Grain production per person worldwide this year totals 299 kilograms, down from the peak of 342 kilograms in 1984.[3] (See Figure 2.) This 14-percent decline since 1984 contrasts with a 38-percent gain from 1950 to 1984, a period of widespread progress in reducing hunger and malnutrition worldwide.[4]

Links: pp 34, 102, 126, 134

The poor harvests of the last two years are a result of weak world prices for grain, of drought stretching from the Middle East through central Asia and across northern China, and of spreading shortages of irrigation water. Prices will recover and the drought will end, but irrigation water shortages will worsen as population growth outruns the water supply in more and more countries.

The longer-term worldwide drop in grain production per person has been concentrated in Africa, Eastern Europe, and the former Soviet Union.[5] In Africa, soil degradation and aridity have constrained gains in food production. Limited gains or declines in grain output, coupled with the fastest population growth of any continent, have increased hunger and malnutrition.[6] Economic decline in the former Soviet Union and Eastern Europe following economic reforms and the breakup of that large nation a decade ago greatly reduced both grain production and consumption.[7]

China, the world's largest grain producer, is primarily responsible for the decline in grain-harvested area in the last two years that has lowered the world grain harvest so dramatically.[8] While world output was dropping 30 million tons in the last two years, China's grain harvest shrunk by 53 million tons, more than offsetting modest gains elsewhere.[9]

Among the forces shrinking China's grain harvest are severe drought in the north during the last two years, spreading irrigation water shortages as aquifers are depleted and as water is diverted to cities, and a lowering of support prices.[10] In a country dependent on irrigated land for 70 percent or more of its grain, water shortages are fast becoming a security issue.[11]

In 1994, in an ambitious and initially successful effort to be self-sufficient, China raised grain support prices by 40 percent.[12] Unfortunately, the drain on the treasury was too great, so the support prices were lowered in 2000 and 2001, dropping close to world market levels.[13] As grain prices have fallen over the last three years, the area planted to grain has shrunk by 10 percent.[14]

China has absorbed the harvest shortfall by drawing down stocks, but there are signs that supplies are now tightening.[15] If this huge nation, with a population equal to that of India and the United States combined, has another large harvest shortfall, it will likely have to import substantial quantities of grain to maintain food price stability.

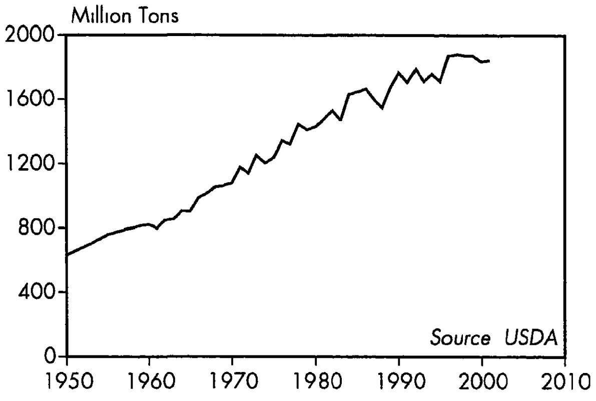
Among the three major grains, the harvest of the two food grains—wheat and rice—each dropped in 2001 from the previous year.[16] (See Figure 3.) Corn, used mostly as a feed grain for livestock, poultry, and fish, edged out wheat again as the world's leading grain.[17]

Although world grain production was down during the last two years, consumption continued to rise.[18] Grain use exceeded production by 35 million tons in 2000 and by 51 million tons in 2001.[19] The excess of production over consumption dropped grain stocks as a share of consumption to 23 percent—one of the lowest levels in two decades.[20]

If world grain demand continues to grow during 2002 at the same pace as the last decade—16 million tons a year—then this year's harvest will have to jump by 70 million tons to avoid a further drawdown in stocks.[21]

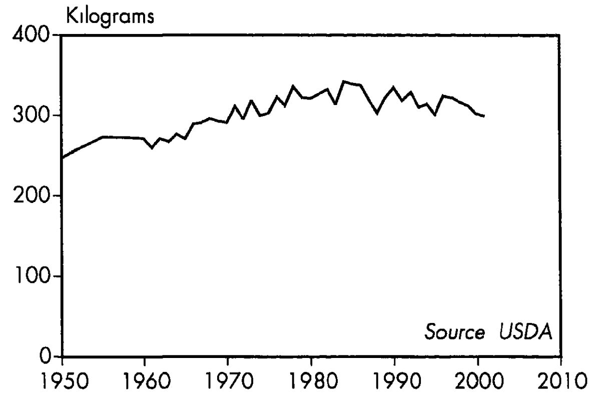
With grain stocks at such a low level, grain market analysts will be watching the 2002 harvest closely. If it falls well short of consumption, grain prices will likely climb. Spreading shortages of irrigation water as aquifers are depleted and as water is diverted to cities are making it much harder for the world's farmers to keep up with the growth in demand.

Grain Harvest Lagging Behind Demand



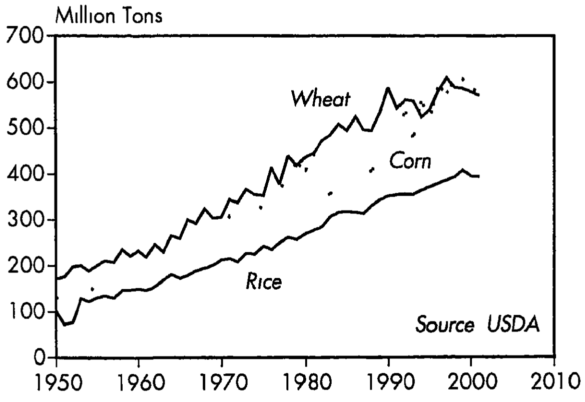
Source USDA

Figure 1 World Grain Production, 1950–2001



Source USDA

Figure 2 World Grain Production Per Person, 1950–2001



Source USDA

Figure 3 Wheat, Corn, and Rice Production, 1950–2001

World Grain Production, 1950–2001

Year	Total (mill tons)	Per Person (kilograms)
1950	631	247
1955	759	273
1960	824	271
1965	905	270
1970	1,079	291
1971	1,177	311
1972	1,141	295
1973	1,253	318
1974	1,204	300
1975	1,237	303
1976	1,342	323
1977	1,319	312
1978	1,445	336
1979	1,411	322
1980	1,430	321
1981	1,482	327
1982	1,533	332
1983	1,469	313
1984	1,632	342
1985	1,647	339
1986	1,665	337
1987	1,598	318
1988	1,549	303
1989	1,671	322
1990	1,769	335
1991	1,708	318
1992	1,790	328
1993	1,713	310
1994	1,760	314
1995	1,713	301
1996	1,871	324
1997	1,880	322
1998	1,872	316
1999	1,871	312
2000	1,836	302
2001 (prel)	1,843	299

Source USDA, *Production, Supply, and Distribution*, electronic database, December 2001

Meat Production Hits Another High

Lester R Brown

World meat production climbed to a new high in 2001, marking the forty-first consecutive annual gain[1] (See Figure 1) At 237 million tons, this is up more than 2 percent over the 232 million tons of 2000[2]

Meat production has increased more than fivefold since 1950[3] Over this half-century, consumption per person has more than doubled, climbing from 17 kilograms to 39 kilograms[4] (See Figure 2)

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Beef, pork, and poultry account for over 90 percent of world meat production[5] (See Figure 3) Most of the growth in meat output in 2001 was in pork and poultry, beef production rose less than 1 percent[6] In fact, beef production per person has fallen by 17 percent since the historical peak in 1976[7]

The key beef-consuming countries are the United States (12 million tons), Brazil (just over 6 million tons), and China (just under 6 million tons)[8] These three account for half of world beef consumption[9] The European Union (EU) also weighs in with just over 6 million tons[10]

World pork production, which overtook beef production in 1979, continued to widen the lead in 2001 as production climbed to 93 million tons, a gain of more than 3 percent[11] Pork consumption is totally dominated by China, at 42 million tons, compared with 8 million tons in the United States, the second-ranking consumer[12] No country dominates the consumption of a meat the way China does pork, accounting for half of world consumption[13] The EU countries collectively eat 16 million tons of pork a year[14]

World poultry production climbed from 67 million tons to almost 69 million tons, also gaining nearly 3 percent[15] The steadily growing world production of poultry eclipsed that of beef in 1995, moving it into second place behind pork[16] As of 2001, poultry consumption worldwide reached 10 kilograms per person[17]

The United States still leads in consumption of poultry, with nearly 14 million tons, but China is closing fast at just under 13 million tons and could eclipse the United States within a few years[18] Brazil, at just over 5 million tons of poultry, is in third place[19] Poultry consumption in the EU is nearly 8 million tons[20]

Despite the uninterrupted growth in world meat consumption for more than half a century, there have been some local disruptions in recent years For example, meat consumption in Russia declined precipitously over the last decade following economic reforms but is now beginning to recover[21] Meat production in the EU was disrupted a few years ago with evidence of mad cow disease and more recently by an outbreak of foot-and-mouth disease[22] Europe is also now showing signs of recovery[23] The identification of two cows with mad cow disease in Japan in the fall of 2001 has lowered beef consumption there[24]

The share of world meat output that is being traded is rising, totaling nearly 16 million tons in 2001[25] Growth in international meat trade reflects both the rising appetite for meat in middle-income countries and advances in storage and transport Although meat is much more difficult to ship internationally than grain, the share of world meat consumption that is traded is now 8 percent, compared with 12 percent for grain[26]

Although meat consumption is at the near saturation point in most industrial countries, it is still growing rapidly in low- and middle-income countries, where most of the world lives The growth in consumption in middle-income countries is evident in the most recent data China, for example, has now emerged as the world's leading meat producer and consumer, eating some 61 million tons of meat in 2001[27] The United States is second, at 34 million tons and Brazil is third, at 13 million tons[28]

While future growth in meat consumption in both the United States and Europe is expected to be limited, there is a broad potential for greater consumption not only in China and Brazil, but in other developing countries as well, such as Mexico, Thailand, and Indonesia[29] Barring a depression in the global economy or a major disruption from livestock disease, world meat consumption is likely to continue its uninterrupted growth for the foreseeable future

Meat Production Hits Another High

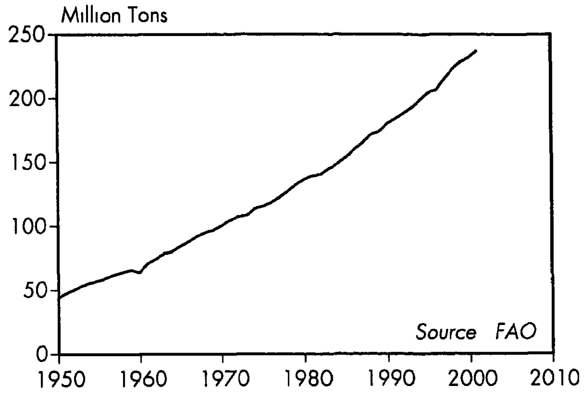

Figure 1 World Meat Production, 1950–2001

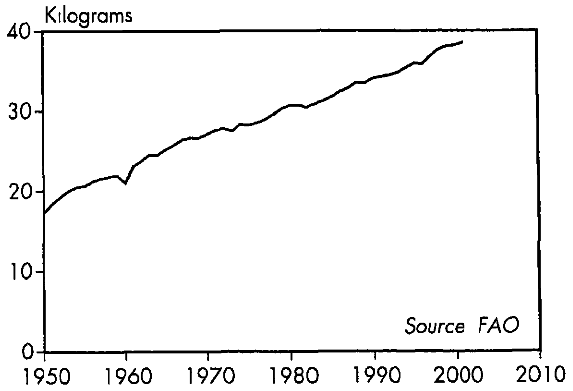

Figure 2 World Meat Production Per Person, 1950–2001

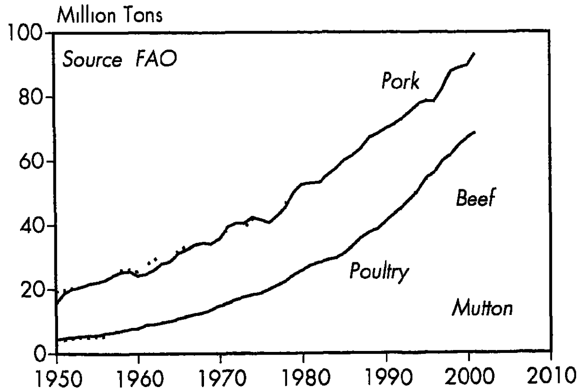

Figure 3 World Meat Production by Source, 1950–2001

World Meat Production, 1950–2001

Year	Total (mill tons)	Per Person (kilograms)
1950	44	17 2
1955	58	20 7
1960	64	21 0
1965	84	25 2
1970	100	27 1
1971	105	27 6
1972	108	27 8
1973	108	27 5
1974	114	28 3
1975	116	28 3
1976	118	28 5
1977	122	28 9
1978	127	29 6
1979	133	30 2
1980	137	30 6
1981	139	30 7
1982	140	30 4
1983	145	30 9
1984	149	31 2
1985	154	31 8
1986	160	32 3
1987	165	32 8
1988	171	33 5
1989	174	33 4
1990	180	34 0
1991	184	34 3
1992	187	34 4
1993	192	34 8
1994	199	35 4
1995	205	36 0
1996	207	35 8
1997	215	36 8
1998	223	37 6
1999	229	38 1
2000	232	38 2
2001 (prel)	237	38 6

Source FAO, *FAOSTAT Statistics Database*, at <apps fao org>, updated 7 November 2001.

Cocoa Production Jumps

Kathleen Huvane

Global cocoa production in 2000 exceeded 3.2 million tons, a 10.5-percent increase from 1999 levels.[1] (See Figure 1.) Production expanded nearly threefold between 1961 and 2000.[2] And over the past century, as chocolate has become a staple rather than a luxury item in wealthy countries, production increased 24-fold.[3]

Although more than 50 nations grow cocoa, the top five producers account for over 70 percent of the total crop.[4] (See Figure 2.) Land area under cocoa cultivation increased 67 percent between 1961 and 2000, but major producing nations have scarce land resources left.[5] The economies of many producing countries hinge upon the cocoa trade. Côte d'Ivoire and Ghana, which grow three fifths of the world's cocoa, each rely on the crop for more than 20 percent of their export revenues.[6]

Falling prices in the 1990s caused Malaysian farmers to shift from cocoa to other crops like palm oil.[7] And Nigeria's cocoa industry is still rebounding from the 1970s petroleum boom that reduced the relative profitability of this crop.[8] Cocoa prices in 2000 reached record lows: three times lower than in 1960, and four times below the price in 1980.[9]

Development of the organic chocolate industry, which represents 1 percent of the chocolate market, provides an alternative for farmers seeking a greater share of the profits. Though the organic market is small, it has grown by 400 percent since 1998, and is expected to expand another 60 percent by 2002.[10]

Cacao trees grow best in humid tropical forests situated within 10 degrees of the equator.[11] As the trees age, productivity decreases, while vulnerability to pests and disease increases. Cocoa cultivated under full sun, as is two thirds of Côte d'Ivoire's crop, yields bumper crops initially, but returns diminish as soil moisture and fertility decline.[12]

Seeds of the cacao tree are ground into cocoa liquor, and separated into cocoa butter and powder. Three varieties dominate production: Criollo, Forastero, and Trinitario, a natural genetic cross.[13] The latter two account for 90 percent of production. With 40 percent fewer seeds per pod, Criollo plants have lower yields, but their superior quality fetches the highest market price.[14] Composed of 40 percent fat, 40 percent carbohydrates, and 20 percent protein, cocoa has more caffeine per liquid ounce than Pepsi-Cola.[15]

Three fourths of the 1998–99 crop was imported by Europe and the United States.[16] Most cocoa is exported whole, but producer countries are expanding their grinding operations, which accounted for 32 percent of global grindings in 2000–01.[17] Between 1996 and 1998, Côte d'Ivoire doubled its grinding capacity, capturing more profits but at the same time wedding its economy to continued cocoa production.[18]

Since chocolate may contain sugar, milk, oil, and other ingredients, chocolate consumption is not a direct measure of cocoa consumption. The average northern European eats 8.5 kilograms of chocolate annually, more than the average African eats in a lifetime.[19] Because markets in Europe and the United States are relatively saturated, producers are beginning to focus on markets in Africa, Asia, and Latin America, where four fifths of the world's population consume just one fifth of the world's cocoa.[20] (See Figure 3.)

Small landholders, who produce 90 percent of the world's cocoa, have a comparative advantage in lower labor and input costs. The estimated 15,000 children who provide forced labor to cocoa, coffee, and cotton farms in northern Côte d'Ivoire reveal the brutal tactics used by some producers to ensure profitability.[21] In December 2001, chocolate manufacturers, consumer groups, and labor advocates signed an accord addressing these labor abuses.[22]

Production of cocoa and other economically valuable non-timber forest products in the shade of the rainforest can boost local incentives for forest conservation and reduce encroachment in protected areas. Diversification leaves farmers less vulnerable to market fluctuations, diseases, and pests, reduces chemical input requirements, and provides secondary habitat and corridors for native forest species and seasonal migrants.[23]

Cocoa Production Jumps

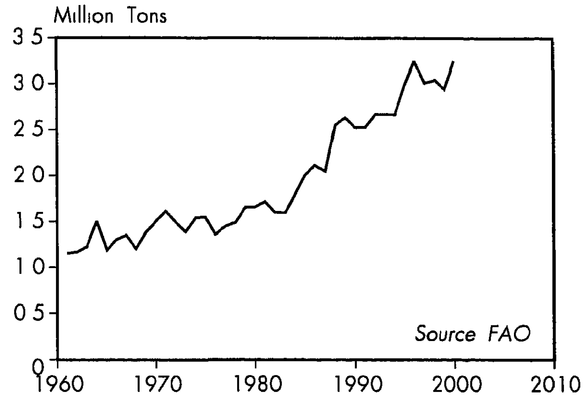

Figure 1. World Cocoa Production 1961–2000

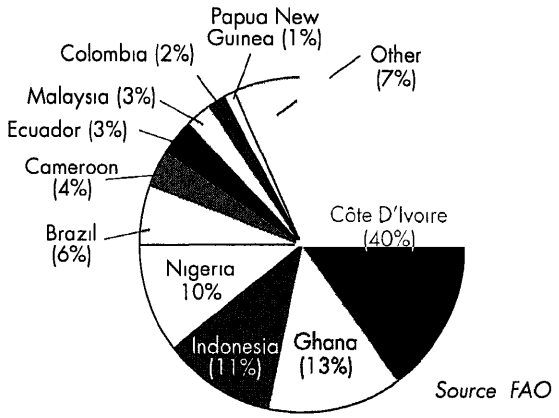

Figure 2. World Cocoa Production by Country, 2000

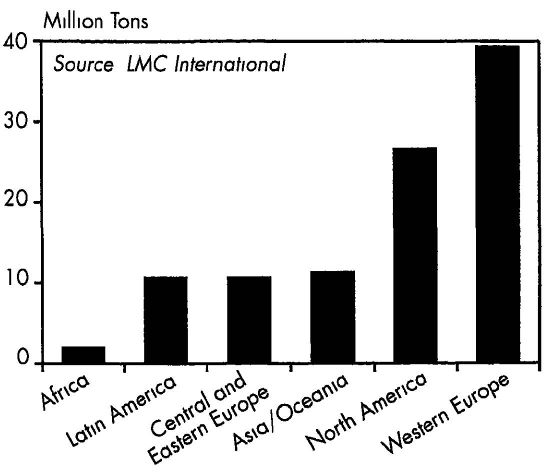

Figure 3. Cocoa Consumption by Region, 1997–98

World Cocoa Production, 1961–2000

Year	Production (million tons)
1961	1.2
1965	1.2
1970	1.5
1971	1.6
1972	1.5
1973	1.4
1974	1.5
1975	1.5
1976	1.4
1977	1.4
1978	1.5
1979	1.6
1980	1.7
1981	1.7
1982	1.6
1983	1.6
1984	1.8
1985	2.0
1986	2.1
1987	2.0
1988	2.6
1989	2.6
1990	2.5
1991	2.5
1992	2.7
1993	2.7
1994	2.7
1995	3.0
1996	3.2
1997	3.0
1998	3.0
1999	3.0
2000	3.2

Sources: FAO, *FAOSTAT Statistics Database*, at <apps.fao.org>, updated 7 November 2001.

Sugar and Sweetener Use Grows

Erik Assadourian

The consumption of sugar and other sweeteners, which are added to foods to enhance flavor, reached an estimated 157 million tons in 2001, more than 2.5 times the figure in 1961.[1] (See Figure 1.) Global per capita consumption rose from 194 calories per day in 1961 to 245 calories in 2001.[2] (See Figure 2.)

The overwhelming majority of sweetener is sugar (sucrose), derived from sugarcane and sugar beets, which contributes almost 90 percent of the sweetener supply.[3] India and Brazil, the two largest global sugar producers, produced more than a quarter of the world's sugar supply (36 million tons) in 2001.[4]

At 11.7 million tons, the next largest source of sweetener is high-fructose syrups (HFS), which are primarily produced from corn and used mostly to sweeten soft drinks.[5] HFS accounts for 7 percent of the global sweetener supply, about three quarters of which is consumed in the United States.[6] Other sweeteners include honey, maple syrup, sugar alcohols, and fruit-derived sugars, as well as high-intensity (artificial) sweeteners like saccharin and aspartame.

Link p. 140

Worldwide, consumption of sugar increased at a modest 1 percent in 2001. Some of the fastest growth occurred in China, where it grew by 4 percent.[7] Globally, consumption of high-fructose syrup grew more rapidly, increasing 2.9 percent in 2001.[8] Over the last 10 years, HFS consumption has increased 50 percent while sugar consumption grew by 22 percent.[9]

Even faster growth has been seen in the high-intensity sweetener category. In 1999, consumption of these totaled 59,100 tons, more than a 10-fold increase since 1966.[10] As high-intensity sweeteners are anywhere from 30 to 600 times sweeter than sucrose, consumption at this level was the equivalent of using an additional 10.8 million tons of sugar.[11]

High-intensity sweeteners are essentially non-caloric, making them popular in diet beverages and foods.[12] Unlike all other sweeteners, most of these are produced not from plants but from petrochemicals. The debate continues about whether these products are harmful. The United States retracted its carcinogen warning for saccharin in 2000, while Canada has banned saccharin usage in food products since 1978.[13]

The largest consumers of sugar and sweeteners are India and the United States, having used 30 percent of the total—46 million tons—in 1999. China also used a significant amount, at 9 million tons. Considering consumption per capita, however, the United States is by far the leader—using almost three times as many sweeteners as India and 10 times as many as China.[14] (See Figure 3.) Americans on average consumed 686 calories of sweeteners a day in 1999—more than a quarter of the recommended 2,250-calorie diet.[15]

Because sweeteners are just empty calories, containing no vitamins or minerals, the World Health Organization considers them an unnecessary part of the diet.[16] Yet sweetener consumption is growing, especially in the developing world, where it has jumped 61 percent since 1961.[17] In China, per capita consumption during this period has more than tripled.[18] This growth is being pushed along by the falling costs of processed foods, growing income, heavy marketing of high-sugar foods, and urbanization, all of which are associated with eating more sweets.

Diets high in added sugars can contribute to high rates of tooth decay, especially in the absence of preventative dental care.[19] Further, as refined foods are introduced into new areas of the world, the cavity-causing effects of sugars are exacerbated by the reduction in consumption of more fibrous foods that help to inhibit decay.[20]

Sugar and sweeteners often squeeze more nutritious foods out of the diet. While Americans on average eat almost three times as much sweeteners as the recommended maximum, they eat only a third to two thirds as much fruit as they should.[21] Yet when other foods are not displaced, increased sweetener consumption can contribute to increases in obesity, which has been linked to diabetes, certain cancers, and heart disease.[22]

Sugar and Sweetener Use Grows

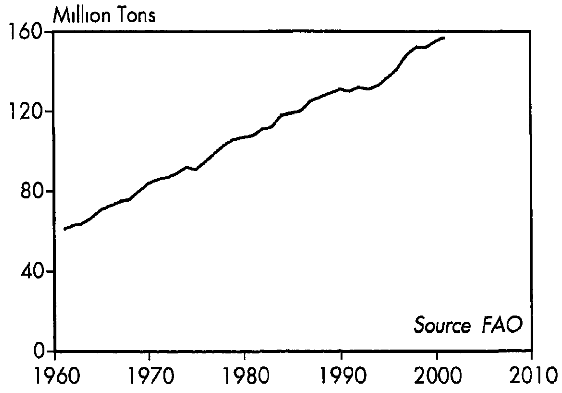

Figure 1 World Sugar and Sweetener Consumption, 1961–2001

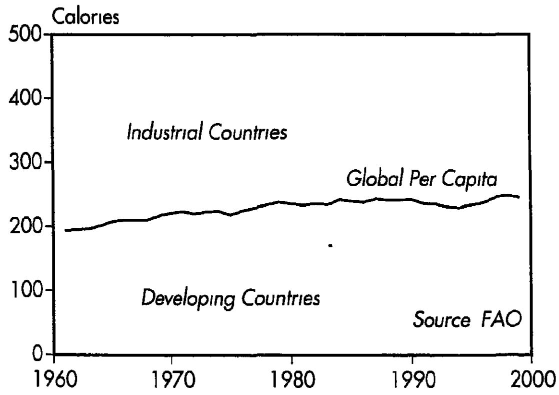

Figure 2 World Sugar and Sweetener Consumption Per Person, 1961–2000

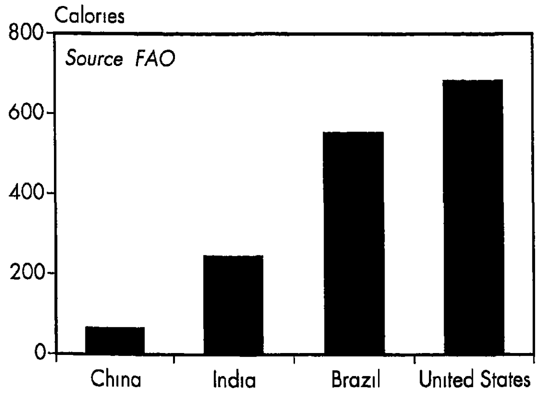

Figure 3 Daily Consumption of Sweeteners Per Person, Selected Countries, 1999

World Sugar and Sweetener Consumption, 1961–2001

Year	Consumption (million tons)
1961	61
1965	71
1970	84
1971	86
1972	87
1973	89
1974	92
1975	91
1976	95
1977	99
1978	103
1979	106
1980	107
1981	108
1982	111
1983	112
1984	118
1985	119
1986	120
1987	125
1988	127
1989	129
1990	131
1991	130
1992	132
1993	131
1994	133
1995	137
1996	141
1997	148
1998	152
1999	152
2000 (prel)	155
2001 (prel)	157

Sources FAO, *FAOSTAT Statistics Database*, at <apps fao org>, updated 7 November 2001, USDA, *Production Supply, and Distribution*, electronic database, December 2001

Irrigated Area Rises

Janet Larsen

In 1999, the latest year for which global figures are available, world irrigated area rose by 3 million hectares to 274 million hectares—a gain of 1.1 percent.[1] (See Figure 1.) Since peaking in 1978, irrigated land per person has declined to around 0.046 hectares.[2] (See Figure 2.)

Asia, with an increase of 1.7 percent, is responsible for the worldwide irrigation expansion in 1999.[3] This continent holds 70 percent of total irrigated area.[4] (See Figure 3.) China and India claim 54 million and 59 million irrigated hectares respectively—41 percent of the total.[5]

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Since 1995, irrigated area in other parts of the world has remained steady, or, as in Europe and Oceania, has declined.[6] Irrigation expansion has largely bypassed Africa: just 6 percent of the continent's farmland is irrigated, up from 5 percent in 1961.[7]

The crop yield on irrigated lands is often twice that of rain-fed lands because individual plants grow better with a controlled water supply and because two or three harvests may be reaped from the same plot each year. The 274 million hectares under irrigation represent only 18 percent of farmland worldwide, but they produce some 40 percent of global agricultural goods and 60 percent of world grain supply.[8]

Some 2,500 cubic kilometers of water were applied to farmland in 1999, approaching 70 percent of all fresh water withdrawn by humans.[9] When water supplies dwindle, however, economics tends to favor industry over agriculture and in many parts of the world, water is diverted away from the field. In the last half-century, agricultural water consumption doubled but industrial consumption jumped sixfold.[10]

China, India, and the United States contain half of the world's irrigated area and produce almost half the grain supply, yet water supplies in each country show signs of depletion.[11] The water table under the North China Plain, which produces 25 percent of China's grain harvest, drops 1.5 meters annually.[12] Beneath the Punjab, India's breadbasket, the water table is falling a half-meter each year.[13] Since 1978, farmers in the southern Great Plains of the United States have cut back over 1 million hectares once watered from the Ogallala aquifer.[14] The country faces further losses if the Ogallala, which supports one fifth of U.S. irrigated land, continues to be depleted at the brisk rate of some 12 billion cubic meters a year.[15]

Worldwide tallies of irrigation area do not necessarily account for the conversion of irrigated land to other uses or the abandonment of land because of water scarcity or environmental damage. Salinization, which occurs when water evaporates from upper soil layers, leaving behind excess salts, inhibits production on one out of every five hectares of irrigated land worldwide, reducing the income of the world's farmers by more than $11 billion.[16]

Global irrigation efficiency, the ratio of water actually used by plants to the amount of water extracted, now averages only 43 percent, largely because 90 percent of the land that is artificially watered is under highly inefficient flood and furrow irrigation.[17] Improved irrigation efficiency can raise both land and water productivity.

Low-pressure and low-energy precision application sprinkler systems in the U.S. Texas High Plains, for example, at efficiencies of 80–95 percent, have produced water savings of 25–37 percent over conventional furrow systems.[18] Drip irrigation, used on an estimated 2.8 million hectares worldwide, could more than halve water use while raising yields anywhere from 20 to 90 percent.[19] Because they deliver water directly to plant roots, drip irrigation systems can have application efficiencies as high as 95 percent.[20]

Though traditionally viewed as costly and suitable only for large commercial farms, new affordable small-scale drip irrigation schemes have the potential to boost annual income for the world's rural poor by some $3 billion annually while improving food production and reducing hunger in drought-prone areas.[21] In both India and China, drip irrigation could be expanded over some 10 million hectares.[22] With water for irrigation expected to be increasingly scarce in the future, the importance of water-efficient technologies and farming practices will grow.

Irrigated Area Rises

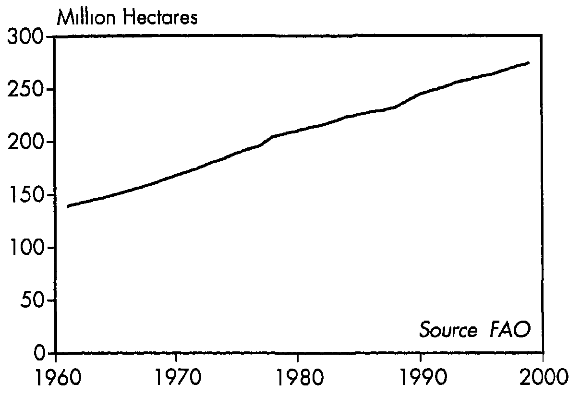

Figure 1 World Irrigated Area, 1961–99

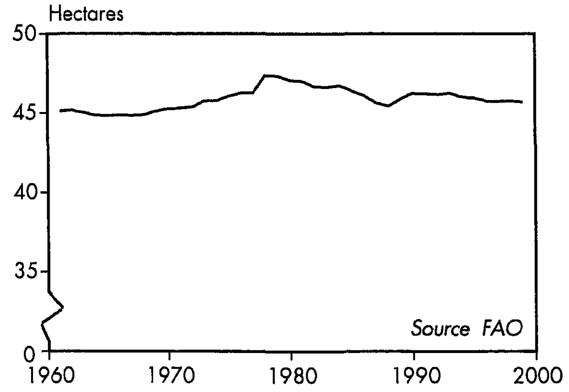

Figure 2 World Irrigated Area, Per Thousand People, 1961–99

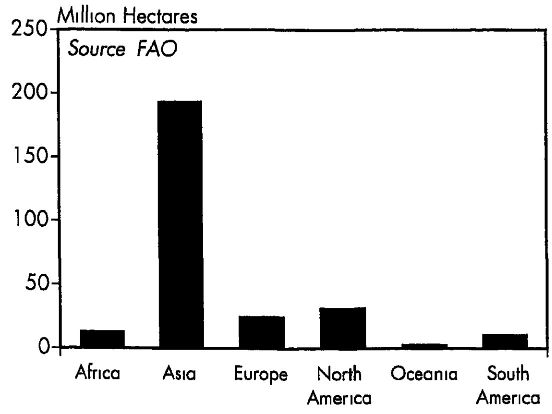

Figure 3 Irrigated Area by Continent, 1999

World Irrigated Area and Irrigated Area Per Thousand People, 1961–99

Year	Total	Area Per Thousand People
	(mill hectares)	(hectares)
1961	139	45 1
1965	150	44 8
1970	168	45 3
1971	172	45 3
1972	175	45 4
1973	180	45 8
1974	184	45 8
1975	188	46 0
1976	192	46 3
1977	196	46 3
1978	204	47 4
1979	207	47 3
1980	210	47 1
1981	213	47 0
1982	215	46 7
1983	219	46 6
1984	223	46 7
1985	225	46 4
1986	228	46 1
1987	229	45 6
1988	232	45 4
1989	238	45 9
1990	244	46 2
1991	248	46 2
1992	251	46 1
1993	256	46 2
1994	258	46 0
1995	261	45 9
1996	264	45 7
1997	267	45 7
1998	271	45 8
1999	274	45 7

Source FAO, "Irrigation" and "Land Use," *FAOSTAT Statistics Database*, at <apps fao org>, updated 10 July 2001

Energy Trends

ELIZABETH CECELSKI ENERGIA M/MC PHOTOSHARE WWW.JHUCCP.ORG/MMC

Fossil Fuel Use Inches Up
Nuclear Power Up Slightly
Wind Energy Surges
Solar Cell Use Rises Quickly
Compact Fluorescents Set Record

Fossil Fuel Use Inches Up

Seth Dunn

World consumption of coal, oil, and natural gas rose by 1 3 percent in 2001, to 7,956 million tons of oil equivalent, according to a preliminary estimate based on industry and government sources [1] (See Figure 1) Since 1950, fossil fuel use has increased by more than fourfold [2]

Global oil consumption grew by 0 2 percent, to 3,511 million tons of oil equivalent, based on preliminary statistics from the International Energy Agency (IEA) [3] (See Figure 2) In the United States, which accounts for 26 percent of world oil use, consumption stayed level [4] It fell by 0 2 percent in Europe, but rose by 1 9 percent in China and declined by 0 2 percent in Asia as a whole [5] Oil use rose the most in the former Soviet bloc and the Middle East, by 2 1 and 3 4 percent, respectively [6] Africa registered a 1 3-percent increase in oil consumption, while Latin America logged a 1 2-percent decline [7]

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Natural gas consumption rose by 3 2 percent to 2,233 million tons of oil equivalent [8] The United States, with 27 percent of global natural gas use, saw a 1 9-percent drop [9] Among industrial nations as a whole, however, gas consumption dipped by just 0 2 percent [10]

Global coal use rose by 1 2 percent, to 2,212 million tons of oil equivalent [11] In the United States, which uses 26 percent of world coal, consumption increased by 0 7 percent [12] China, with a 22-percent share of coal use, saw a 1 1-percent rise, according to preliminary estimates [13] This departure from several years of reported declines in Chinese coal use may, however, reflect a correction of official statistics that had understated consumption by excluding illegal coal mines from calculations [14]

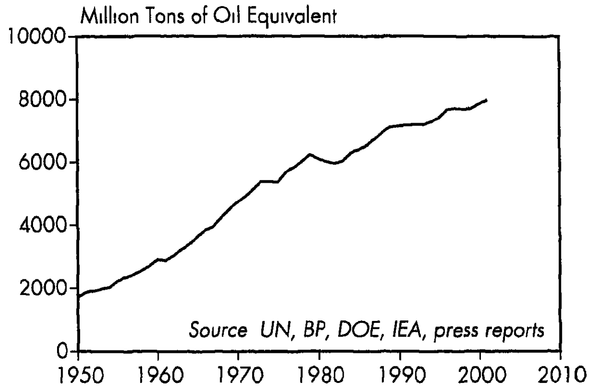
A major uncertainty in assessing future fossil fuel use trends is cost [15] While improvements in technology and productivity are bringing down production and transportation costs, the cheapest reserves are being depleted, and new supplies must be brought over increasingly long distances—driving energy costs upward As natural gas reserves near the market are depleted, for example, costs rise as supplies must be shipped from further afield At the same time, renewable energy resources, which can be harnessed at a local or regional level, are in general becoming less costly to produce—and more competitive with fossil sources

Another uncertainty in projecting fossil fuel trajectories is price In particular, oil prices are highly uncertain because they depend on the policies of major oil-producing countries In late December 2001, ministers from the Organization of Petroleum-Exporting Countries (OPEC) committed to cutting crude oil supply during the first six months of 2002, shortly after five non-OPEC producers agreed to reduce their production or exports [16]

As the IEA's *World Energy Outlook 2001* report points out, there are more than enough reserves of oil, gas, and coal to meet projected growth in energy demand through 2020 [17] But exploiting these reserves will require massive investments in energy production and transportation infrastructure, which in turn will have to be measured against the policy objectives of energy security and environmental protection It is unclear, for example, how willing Middle East oil producers will be to exploit their low-cost reserves Use of natural gas will depend, meanwhile, on the further development of technology and future prices [18]

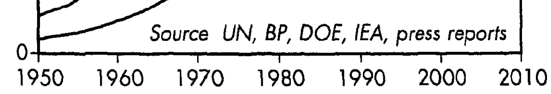
Renewable energy also poses a long-term threat to fossil fuels and has received added attention in the wake of the events of September 2001 and growing concern over climate change and energy security If strong government backing achieves further reductions in the cost of renewables, the IEA study notes, there is "a huge potential for expanding the supply," which would over time cut significantly into coal use for power generation [19] Beyond 2020, the IEA concludes, new technologies such as hydrogen-based fuel cells "hold out the prospect of abundant and clean energy supplies in a world largely free of climate-destabilising carbon emissions "[20]

Fossil Fuel Use Inches Up



Source UN, BP, DOE, IEA, press reports

Figure 1 World Fossil Fuel Consumption, 1950–2001



Source UN, BP, DOE, IEA, press reports

Figure 2 World Fossil Fuel Consumption, by Source, 1950–2001

World Fossil Fuel Consumption, 1950–2001

Year	Coal	Oil	Natural Gas
	(mill	tons of oil	equivalent)
1950	1,074	470	171
1955	1,270	694	266
1960	1,544	951	416
1965	1,486	1,530	632
1970	1,553	2,254	924
1971	1,538	2,377	988
1972	1,540	2,556	1,032
1973	1,579	2,754	1,059
1974	1,592	2,710	1,082
1975	1,613	2,678	1,075
1976	1,681	2,852	1,138
1977	1,726	2,944	1,169
1978	1,744	3,055	1,216
1979	1,834	3,103	1,295
1980	1,814	2,972	1,304
1981	1,826	2,868	1,318
1982	1,863	2,776	1,322
1983	1,914	2,761	1,340
1984	2,011	2,809	1,451
1985	2,107	2,801	1,493
1986	2,143	2,893	1,504
1987	2,211	2,949	1,583
1988	2,261	3,039	1,663
1989	2,293	3,088	1,738
1990	2,270	3,136	1,774
1991	2,225	3,134	1,806
1992	2,211	3,165	1,810
1993	2,206	3,135	1,849
1994	2,224	3,192	1,858
1995	2,258	3,235	1,913
1996	2,342	3,316	2,005
1997	2,327	3,388	1,993
1998	2,281	3,398	2,016
1999	2,160	3,469	2,065
2000	2,186	3,504	2,164
2001 (prel)	2,212	3,511	2,233

Source Worldwatch estimates based on UN, BP, DOE, IEA, and press reports

Nuclear Power Up Slightly

Nicholas Lenssen

Between 2000 and 2001, total installed nuclear power generating capacity increased by 1,505 megawatts (0 4 percent), passing 350,000 megawatts for the first time [1] (See Figure 1) But since 1990, global nuclear capacity has risen just 7 percent—compared with 240-percent growth in the 1980s—an indication of nuclear power's stagnation in the past decade [2]

Only one new reactor was grid-connected in 2001, in Russia, bringing the world's total to 436 [3] The remaining capacity increase in 2001 is due to upgrades at existing reactors, where more power was squeezed from operating units Last year, for the first time ever, there was neither new construction started on a reactor (see Figure 2) nor any operating reactors permanently shut down [4]

Some 26 reactors remain under active construction (with a combined capacity of 23,537 megawatts), with as many as eight of these due for completion in 2002 [5] And a total of 99 reactors (representing more than 30,000 megawatts) have been retired after an average service life of less than 18 years [6] (See Figure 3)

In the United States, 2001 started with industry and government talking about a "nuclear renaissance " The new administration touted nuclear power in its energy plan, and power shortages in California encouraged promoters in believing that the country would seriously consider initiating a new nuclear project for the first time since the early 1970s [7]

The terrorist attacks of September 11th, however, quickly put a damper on these aspirations armed troops were deployed around existing reactors, and even the International Atomic Energy Agency confessed that little could be done to protect nuclear power plants from such airborne attacks [8]

Official or de facto moratoria remain on new nuclear power in most of Western Europe Belgium reiterated its plan to shut down existing plants before they are 40 years old, and the German government and industry formalized an agreement to phase out existing reactors [9]

The United Kingdom considered an energy policy that would include building new reactors, but instead chose to rely on renewable energy sources such as wind [10] In Sweden, the coalition government moved to postpone the planned closure of a unit until 2003 due to the concern that replacement power would not yet be available [11]

A breath of life returned to Russia's nuclear program in 2001, as economic recovery resulted in more funding In addition to the one reactor completed in 2001, work restarted on two others, with plans calling for as many as 10 new reactors in the next decade [12] Russia may also help Ukraine complete two reactors stalled since the 1986 Chernobyl meltdown [13]

Japan's nuclear program continues to face local opposition as public referenda in Kariwa Village and Miyama resulted in votes against nuclear projects [14] Another planned plant was "temporarily suspended" due to local opposition in Amori Prefecture [15] Only four units were under construction in Japan, with two more units in pre-construction safety review

China has the world's largest nuclear expansion effort, with 10 reactors being built to go along with its three operating units [16] Four of the new units are likely to be grid-connected in 2002, and the country initiated work on a site for as many as four more new ones [17] South Korea has four reactors under construction [18] And Taiwan restarted building two units in 2001 after the government's move to scrap the plant in 2000 was declared unconstitutional [19] But the election victory by the Progress Democrat Party in late 2001 is likely to halt the project once again [20]

Numerous other countries—including Argentina, Brazil, India, and Romania—continue to discuss restarting stalled projects or ordering new units, but none of these discussions have yet turned into secure financing, much less cement being poured

Indeed, in a post–September 11th world, many countries and policymakers have reason to reevaluate nuclear energy The threat extends beyond the simple disruption of nuclear power plant operation to the trafficking of nuclear materials On two occasions in late 2001, for example, police arrested black marketers attempting to sell weapons-grade enriched uranium in Russia and Turkey [21]

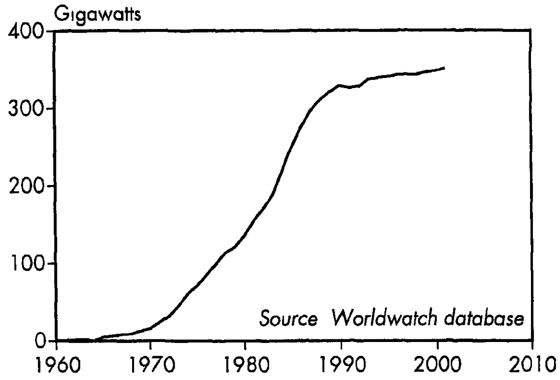


Figure 1 World Electrical Generating Capacity of Nuclear Power Plants, 1960–2001

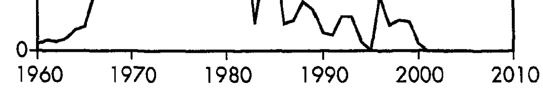


Figure 2 World Nuclear Reactor Construction Starts, 1960–2001

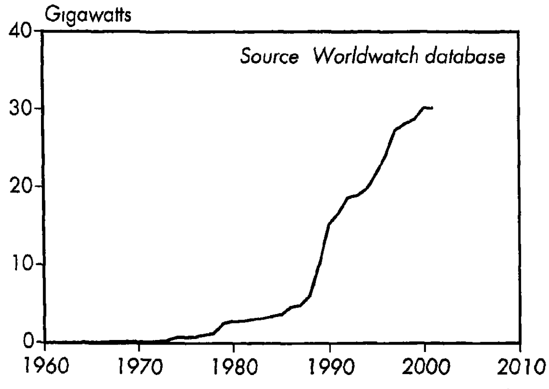


Figure 3 Nuclear Capacity of Decommissioned Plants, 1964–2001

World Net Installed Electrical Generating Capacity of Nuclear Power Plants, 1960–2001

Year	Capacity (gigawatts)
1960	1
1965	5
1970	16
1971	24
1972	32
1973	45
1974	61
1975	71
1976	85
1977	99
1978	114
1979	121
1980	135
1981	155
1982	170
1983	189
1984	219
1985	250
1986	276
1987	297
1988	310
1989	320
1990	328
1991	325
1992	327
1993	336
1994	338
1995	340
1996	343
1997	343
1998	343
1999	346
2000	348
2001 (prel)	351

Source Worldwatch Institute database, compiled from the IAEA and press reports

Wind Energy Surges

Christopher Flavin

Wind energy generating capacity jumped 37 percent, to approximately 24,800 megawatts at the end of 2001.[1] (See Figure 1.) The capacity addition of roughly 6,700 megawatts during the year was up sharply from the year before—and reinforces wind's position as the world's fastest growing energy source.[2] (See Figure 2.) Annual wind capacity additions are now approaching annual additions to global hydropower capacity, and are more than four times the nuclear capacity added in 2001.[3]

Europe now has over 70 percent of the world's wind capacity, thanks mainly to the strong laws encouraging its growth in Germany, Spain, and Denmark.[4] Germany strengthened its role as the world leader in 2001, with 2,600 megawatts added, taking its capacity to over 8,700 megawatts—more than one third of the world total.[5] Wind power now provides 3.5 percent of Germany's electricity, and the government has announced plans to raise that figure to at least 25 percent by 2025, while phasing out the nuclear industry, which now provides 30 percent of the country's power.[6]

Spain established a clear position as Europe's second leading wind generator in 2002, with an additional 1,100 megawatts—taking its total to 3,340 megawatts and providing an estimated 3 percent of the country's electricity.[7] Spain's wind industry is becoming an increasingly important international player, with ventures now under way in other parts of Europe, Latin America, and China. The country's leading wind company, Gamesa Eolica, linked to one of the country's leading aeronautical and industrial enterprises, was 40-percent owned by Denmark's Vestas until the end of 2001, when the Gamesa Group acquired those shares in order to be able to compete with Vestas in markets around the world.[8]

Denmark, which gets a world-leading 18 percent of its electricity from the wind, saw a sharp slowdown in its pace of growth in 2001, with just over 100 megawatts added, taking its total to 2,400 megawatts.[9] The slowdown stems from a government decision in 2000 to end the minimum purchase price requirement and introduce a new system of renewable certificate trading that has not been successfully implemented so far.[10] The situation turned even bleaker in early 2002, when a new right-wing government announced plans to dismantle the country's remaining support for wind energy.[11]

Countering the negative trend in Denmark was Italy's addition of 270 megawatts, moving it into the fourth position in Europe, with nearly 700 megawatts installed.[12] And outside Europe, India reinvigorated its wind power industry in 2001, with an added 300 megawatts, taking the national total to 1,500 megawatts installed.

The United States rejoined the wind energy big leagues in 2001, with nearly 1,700 megawatts added, a rush spurred by a federal tax credit that expired at the end of the year.[13] The country's total installed capacity remains second to Germany's, as it has since the late-1990s. The record-breaking U.S. installations were spread broadly across the country's western plains and mountains, with major projects in Texas, Kansas, and Oregon.[14] Even larger projects are planned, following congressional reinstatement of the federal wind energy tax credit in March 2002.[15]

The newest player on the wind energy scene is Brazil, which was hit hard by drought-induced power shortages in 2001, and is now turning to wind as a quick and affordable way of boosting its generating capacity. Some 4,000 megawatts of wind power projects were authorized by Brazil's federal electricity regulator, Aneel, in late 2001 and early 2002—which could make Brazil the world's fourth largest market in the next two years.[16] Much of the development is occurring in the economically deprived but wind-rich northeastern states of Rio Grande do Norte, Ceara, Pernambuco, and Bahia.[17]

The global wind power industry generated an estimated $7 billion in business in 2001, and is now attracting the interest of the world's largest energy companies, ranging from ABB to Royal Dutch Shell.[18] Another major player joined the scene in early 2002 when General Electric reached agreement with the bankrupt Enron Corp. to purchase the company's wind energy business, which is the largest in North America.[19]

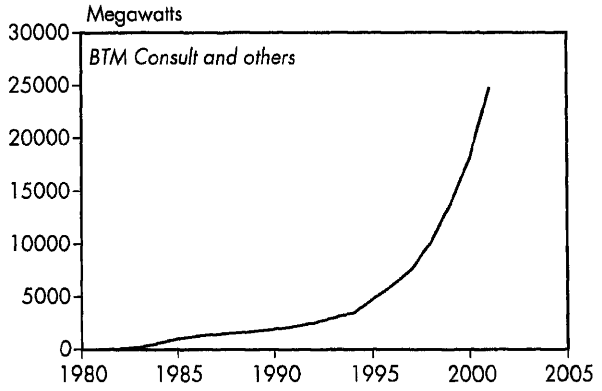


Figure 1 World Wind Energy Generating Capacity, 1980–2001

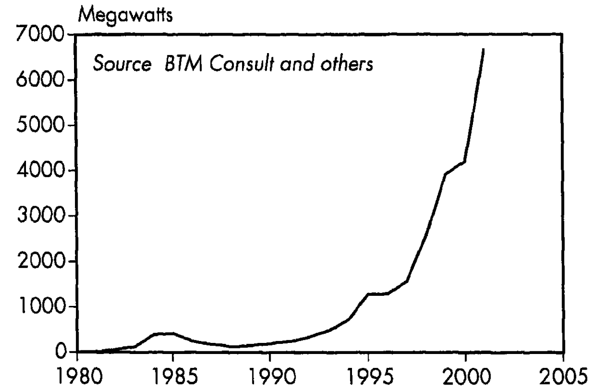


Figure 2 Annual Addition to World Wind Energy Generating Capacity, 1980–2001

World Wind Energy Generating Capacity, Total and Annual Addition, 1980–2001

Year	Total	Annual Addition
	(megawatts)	
1980	10	5
1981	25	15
1982	90	65
1983	210	120
1984	600	390
1985	1,020	420
1986	1,270	250
1987	1,450	180
1988	1,580	130
1989	1,730	150
1990	1,930	200
1991	2,170	240
1992	2,510	340
1993	2,990	480
1994	3,490	730
1995	4,780	1,290
1996	6,070	1,290
1997	7,640	1,570
1998	10,150	2,600
1999	13,930	3,920
2000	18,100	4,200
2001 (prel)	24,800	6,700

Sources BTM Consult, EWEA, AWEA, *Windpower Monthly*, and *New Energy*

Solar Cell Use Rises Quickly

Molly O Sheehan

Production of photovoltaic (PV) cells, which turn sunlight into electricity, exceeded 390 megawatts in 2001, according to a survey of manufacturers [1] The 36-percent surge made 2001 the fourth straight year of growth at or above 30 percent [2] (See Figure 1) The 1,140 megawatts of installed PVs in the world today have just a bit more capacity than the largest coal-fired power plant and account for less than 1 percent of global electricity [3] But if current growth is sustained, PVs could become a globally significant power source within the next three decades [4]

Government support in a few industrial nations has powered the PV market recently, prompting a dramatic leap in the share of PVs that supplement existing power grids Grid-connected PVs accounted for only 14 percent of solar power installed in 1995, but by 2000, they accounted for more than 50 percent, according to a survey by Strategies Unlimited [5]

Japan has subsidized tens of thousands of PV rooftops since 1996 [6] The government paid for 50 percent of a new solar system when it first launched the program, although by 2001 it had lowered the subsidy to 15 percent [7] Japanese manufacturers produced just under 44 percent of the global output in 2001, keeping Japan in the lead as the world's largest PV producer [8] (See Figure 2) As much as 120 of the 171 megawatts of PV cells produced in Japan in 2001 were used in that country [9]

Support for PVs is also strong in Europe, where 86 3 megawatts were produced in 2001 [10] Government initiatives helped spur the purchase of some 65 megawatts in Germany alone, and more than 20 megawatts in other European nations [11]

Although the United States is the second largest producer of solar cells, with an output of 100 3 megawatts in 2001, most of this product is exported [12] State and city initiatives, led by California, are starting to lower barriers for solar, however, and enlarge the market [13] In 2000, just 12 megawatts were purchased in the United States, but that grew by 50 percent in 2001, with 10 megawatts sold in California alone [14]

Over the last two decades, mass production and technological advances have slashed the cost of PVs, but strong demand since the mid-1990s has slowed the decline in prices [15] Some 90 percent of PVs produced in 2001 were made from crystalline silicon, which is sliced into wafers and encased in glass panels [16] The remaining 10 percent is cheaper but less efficient "thin-film silicon which can be made into flexible sheets and integrated into building materials [17] Industry analyst Paul Maycock now quotes two factory prices for PVs $3 50 per watt for the crystalline PVs and $2 for the less efficient thin-film variety [18]

The solar arrays being installed in industrial nations fill an urban niche, helping cities avoid blackouts during peak air conditioning demand [19] As PVs can be mounted directly on homes and businesses, power can be used right where it is generated, eliminating transmission losses Without subsidies, the price of installed solar power can be several times the average retail electricity price, but it can be competitive at times of peak use [20]

There is even greater need for off-grid PVs in the developing world, where some 1 7 billion people live without access to electricity that can help boost education, health, and income by powering water pumps, refrigeration for vaccines, computers, and communications [21] Since 1991, up to $520 million in loans have been pledged by the World Bank Group to support this market, so far, such support has resulted in the installation of an estimated 500,000 off-grid, residential solar systems [22]

The total number of solar systems in the developing world is likely much higher, as nonprofit groups and private entrepreneurs have been helping to devise financing and credit schemes so that businesses and consumers can overcome the high up-front cost of PVs [23] By offering loans, partnering with local microfinance partners, or selling a "fee-for-service" package, the Solar Electric Light Company has sold more than 16,000 solar home systems in India, Sri Lanka, and Viet Nam since it was launched in 1997 [24]

Solar Cell Use Rises Quickly

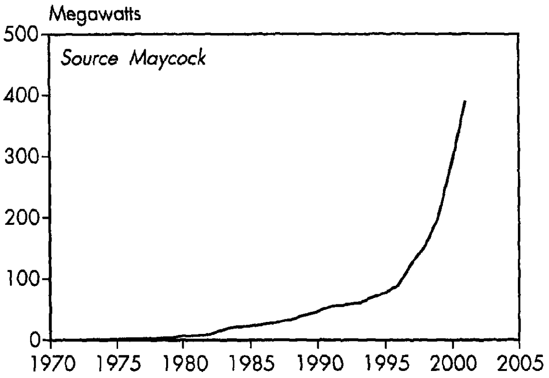


Figure 1 World Photovoltaic Production, 1971–2001

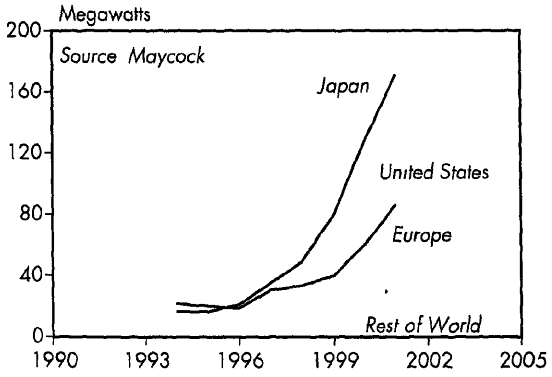


Figure 2 Photovoltaic Production by Country or Region, 1994–2001

World Photovoltaic Production, 1971–2001

Year	Production (megawatts)
1971	0 1
1975	1 8
1976	2 0
1977	2 2
1978	2 5
1979	4
1980	7
1981	8
1982	9
1983	17
1984	22
1985	23
1986	26
1987	29
1988	34
1989	40
1990	46
1991	55
1992	58
1993	60
1994	69
1995	79
1996	89
1997	126
1998	153
1999	201
2000	288
2001 (prel)	391

Source Paul Maycock, *PV News*, various issues

Compact Fluorescents Set Record

Michael Scholand

Global sales of energy-efficient compact fluorescent lamps (CFLs) grew by 15 percent in 2001, achieving record levels of over 600 million units [1] (See Figures 1 and 2) CFLs, a technology with nearly two decades of commercialization, are a tiny version of the common 4-foot fluorescent tubes Compared with incandescent light bulbs they are designed to replace, quality CFLs last about 10 times longer and use just one quarter of the electricity while providing the same amount of light [2]

Between 1988 and 2001, CFL sales increased more than 13-fold [3] There are an estimated 1 8 billion CFLs in operation today, consuming 27,000 megawatts of electricity—much less than the 109,000 megawatts that would be required to operate the same number of incandescent lamps [4] The electricity these CFLs are saving is equivalent to that produced by nearly 40 medium-sized coal-fired power plants [5]

Link p 132

Avoided electricity generation translates into pollution reduction In North America, the 316 million CFLs in use at the start of 2002 will save 4 8 million tons of carbon and 94,000 tons of sulfur dioxide emissions during the year [6] CFLs also reduce energy bills in Thailand, consumers pay about 300 baht ($6 70) for a high-quality CFL that, if lit four hours a day, offers a payback on the additional first cost in just 1 5 years [7] Looking at bulb replacement and electricity savings over the 10,000-hour life of the lamp, a CFL has a net present value of over 1,000 baht—more than three times what it cost [8]

Recognizing a great opportunity, China launched a three-year Green Lights program in January 1997 to expand their efficient-lighting market and improve production quality [9] The program covers education, certification, labeling, demonstrations, and technical assistance [10] China's CFL industry expanded, fueled by this government support and a robust domestic market that grew by over 350 percent in the last six years [11] Today, China manufactures more than 80 percent of the world's CFL supply [12] Growing sales volumes stimulated competition and innovation, reducing prices and improving quality—trends that continue today [13]

Recognizing the economic benefits of CFLs, the International Finance Corporation (IFC) launched the Efficient Lighting Initiative (ELI) in 1999 with support from the Global Environment Facility Now in its third year ELI is expanding the market for efficient lighting in seven countries Argentina the Czech Republic, Hungary, Latvia, Peru the Philippines, and South Africa [14] Russell Sturm program manager at the IFC, indicates that accelerating market adoption of efficient lighting will not only reduce household expenditures, it will also help countries meet their energy needs more cost-effectively and reduce greenhouse gas emissions for less than $5 per ton [15]

In South Africa, ELI has succeeded in raising awareness and gaining market acceptance for this previously unknown technology Barry Bredenkamp of Bonesa, the organization coordinating ELI in South Africa, reported that "after only two years, our program achieved an estimated 59 percent growth in CFL sales in the last year, increasing annual sales to over 4 million lamps We have targeted customers across income groups, including lower-income households that often install a CFL as their first electric light source "[16]

In Peru, South Africa, Argentina, and the Philippines, which have seen an influx of low-cost, low-quality CFLs, ELI provides a labeling scheme to certify the lamps, protecting consumers against counterfeit or inferior products This kind of quality assurance is particularly crucial for the first-time buyer, who could reject the technology outright after a negative experience [17]

While CFL bulbs have many environmental and economic advantages, like all fluorescent lamps they do contain a small amount of mercury Recently, manufacturers have succeeded in reducing the mercury content to less than 5 milligrams per CFL, or about 1 percent as much as a household thermometer [18] Moreover, in the United States energy savings from CFLs cut environmental mercury emissions by reducing electricity produced from coal-burning power stations [19] Consumers can also recycle their CFLs, thereby eliminating any environmental contamination

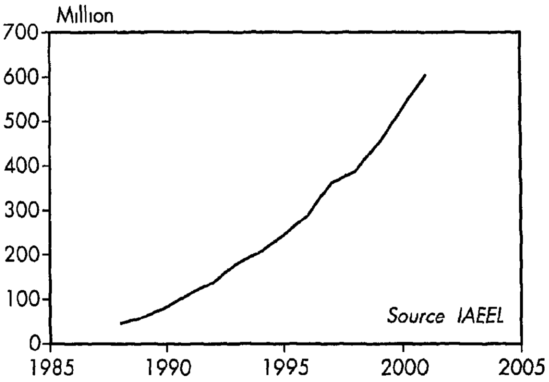
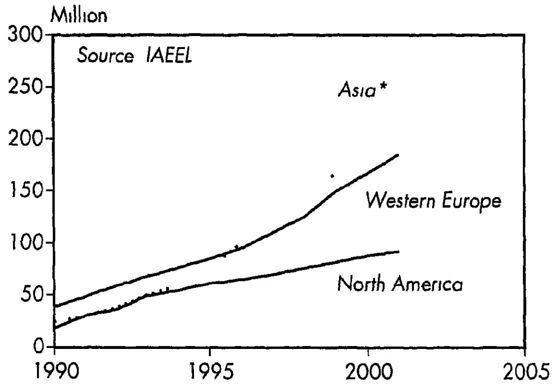


Figure 1 World Sales of Compact Fluorescent Lamps, 1988–2001



*Includes Japan, China, and Asia Pacific

Figure 2 World Sales of Compact Fluorescent Lamps, Selected Regions, 1990–2001

World Sales of Compact Fluorescent Lamps, 1988–2001

Year	Units (million)
1988	45
1989	59
1990	83
1991	112
1992	138
1993	179
1994	206
1995	245
1996	288
1997	362
1998	387
1999	452
2000	528
2001 (prel)	606

Source Nils Borg, IAEEL, e-mails to Worldwatch, 1988–89 from Evan Mills, Lawrence Berkeley Laboratory

Atmospheric Trends

Global Temperature Close to a Record
Carbon Emissions Reach New High
CFC Use Declining

Global Temperature Close to a Record

Seth Dunn

Global surface air temperatures rose to 14 43 degrees Celsius in 2001, based on land and ocean measurements dating back to 1880 from NASA's Goddard Institute for Space Studies (GISS) (See Figure 1)[1] Another GISS dataset, based only on land measurements but extending back to 1867, showed similar results (See Figure 2)[2] Both indicate that 2001 was the second warmest year on record—a finding supported by datasets from the U S National Oceanic and Atmospheric Administration and the U K Hadley Centre for Climate Prediction [3] The warmest year thus far was 1998 [4]

Regional surface patterns reflected above-average temperature conditions, though large parts of the tropical and north Pacific were cooler than average [5] Canada has now had 18 straight seasons of above-average temperatures [6] October 2001 was the warmest October in the 343-year Central England temperature series [7] Some regions experienced unusually cool weather, however [8] Russia registered more than 100 deaths from hypothermia from low temperatures during the 2000–01 winter [9] And northern India saw more than 130 deaths from extreme cold in January 2002 [10]

Link p 52

Several areas experienced above- or below-average rainfall [11] The period from March 1999 to March 2001 was the wettest 24-month period in the 236-year time series for England and Wales [12] India experienced its second lowest total of winter precipitation in early 2001, and a drier-than-normal summer monsoon season that exacerbated water shortages in some areas [13] Several countries, such as Australia and Zambia, experienced a mix of both wetter and drier weather in various locations [14]

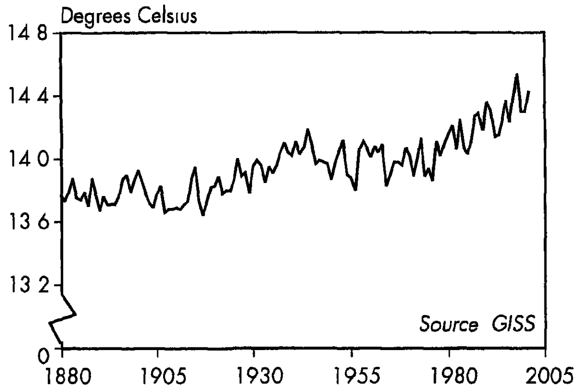
The year saw an above-average number of hurricanes and tropical storms in the north Atlantic basin, with 15 named storms—5 more than the long-term average [15] Tropical Storm Allison caused the most extensive flooding in the United States ever associated with a tropical storm [16] Hurricane Michelle severely affected the coffee crop in Jamaica and was the strongest hurricane to make landfall in Cuba since 1952 [17] In the western Pacific, Typhoon Chebi reached sustained winds of close to 160 kilometers an hour, killing at least 79 people [18]

Unusual flood events were reported [19] Mozambique and Zambia experienced as many as 200 deaths from heavy rainfall that ruined crops and left hundreds homeless [20] Hungary's rain-swollen Tisza River reached its highest level since 1888 [21] In Siberia, rainfall and accelerated snowmelt caused ice-jammed rivers to overflow, destroying or damaging the homes of more than 300,000 people [22] Viet Nam's Mekong Delta region saw several hundred deaths from October flooding [23] Heavy rains in West Africa affected nearly 70,000 people and submerged 17,000 hectares of agricultural land [24] And hundreds were killed in Algiers from Algeria's worst flooding in almost 40 years [25]

Drought affected many areas The region encompassing Iran, Afghanistan, and Pakistan continued to suffer from a devastating drought that began in 1998, with a wet season more than 45 percent below average precipitation [26] This lack of rainfall has stressed both water supplies and agriculture, directly affecting more than 60 million people [27] The region was also subject to periods of extreme heat, one of which caused many deaths in Pakistan in early May [28] Drought persisted in the Greater Horn region of Africa, in Brazil, exacerbating the nation's hydropower supply shortage, and in northern China, the Korean peninsula, and Japan in the first half of 2001 [29] Winter precipitation deficits affected the western United States, and Canada reported drought in many regions from coast to coast [30]

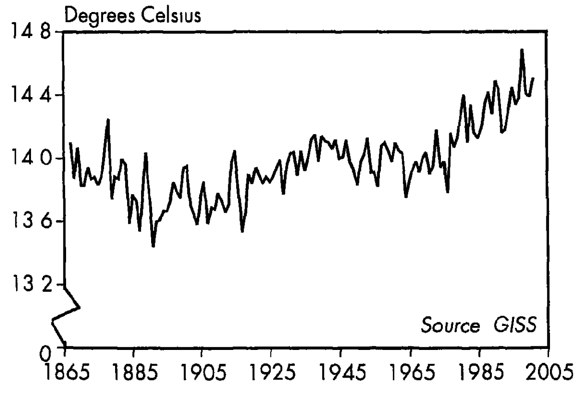
These climatic phenomena are likely to become more frequent and intense as surface temperatures rise, according to the latest assessment of the Intergovernmental Panel on Climate Change [31] Concluding that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities," the panel projects that average global surface temperature will increase by 1 4–5 8 degrees Celsius between 1990 and 2100 [32] The actual temperature rise will be largely determined by future trends in greenhouse gas emissions

Global Temperature Close to a Record



Source GISS

Figure 1 Global Average Temperature at Earth's Surface, 1880–2001



Source GISS

Figure 2 Global Average Temperature at Earth's Surface (Land-Based Series), 1867–2001

Global Average Temperature, 1950–2001

Year	Temperature (degrees Celsius)
1950	13 87
1955	13 88
1960	14 01
1965	13 90
1970	14 02
1971	13 89
1972	14 00
1973	14 13
1974	13 89
1975	13 94
1976	13 86
1977	14 11
1978	14 02
1979	14 10
1980	14 16
1981	14 21
1982	14 06
1983	14 25
1984	14 07
1985	14 03
1986	14 12
1987	14 27
1988	14 29
1989	14 18
1990	14 36
1991	14 31
1992	14 14
1993	14 15
1994	14 25
1995	14 37
1996	14 23
1997	14 39
1998	14 54
1999	14 30
2000	14 30
2001 (prel)	14 43

Source Surface Air Temperature Analysis, Goddard Institute for Space Studies, 25 January 2002

Carbon Emissions Reach New High

Seth Dunn

Global emissions of carbon from fossil fuel combustion increased by 1 1 percent in 2001, reaching a new high of 6 55 billion tons [1] (See Figure 1) This was the second consecutive record-setting year, and the eighth annual record since 1990 Annual carbon emissions have now more than quadrupled since 1950 [2]

Behind the global trend, national and regional emissions patterns vary widely (National data are available only through 2000) The United States, which accounts for 24 percent of the global total, registered an 18 1-percent increase between 1990 and 2000 [3] In contrast, emissions in the European Union (EU) over this period fell by 1 8 percent, owing mainly to declines in Germany and the United Kingdom of 19 and 5 percent, respectively [4] The steepest drops in carbon emissions occurred in former Eastern bloc nations Russia, for example, had a 30 7-percent decline [5]

Links pp 38, 50, 114

Collectively, industrial and former Eastern bloc nations saw a 1 7-percent drop in carbon emissions between 1990 and 2000 [6] This compares with the commitment of these nations, under the 1997 Kyoto Protocol, to reduce emissions of carbon dioxide and other greenhouse gases by 5 2 percent between 1990 and 2010 [7]

Carbon emissions trends among the larger developing nations were generally upward, although starting from a smaller base China's carbon emissions grew by 7 7 percent over the decade, while those of India increased 67 percent [8] However, per capita emissions in China and India—at 0 68 and 0 3 tons—are well below the global average of 1 1 tons, and roughly one seventh and one fourteenth that of the U S average [9]

The carbon intensity of the world economy continued its gradual decline, falling to 150 tons per million dollars of economic output [10] (See Figure 2) This represents a 40-percent decline in carbon intensity since 1950, with half of the decline occurring since 1982 [11] This "decarbonization" trend needs to be accelerated, however, to achieve a 60–80 percent reduction in carbon emissions during this century—which is what scientists believe is necessary to stabilize atmospheric concentrations of carbon dioxide (CO_2) below a doubling of pre-industrial levels [12]

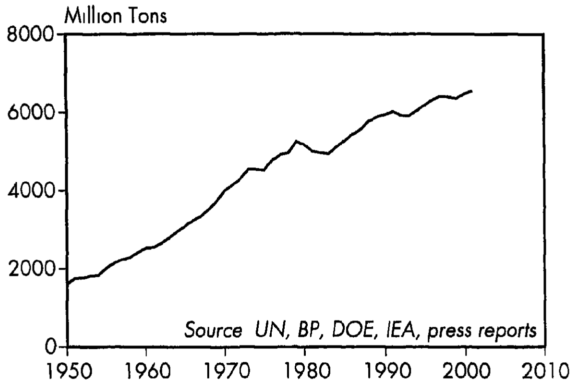
Atmospheric CO_2 levels rose to 370 9 parts per million volume (ppmv) in 2001, according to measurements from the Mauna Loa Observatory in Hawaii, part of a record dating back to 1957 [13] (See Figure 3) The annual increase of 1 49 ppmv, up from 1 11 ppmv the previous year, suggests the possible onset of another El Niño—a climatic phenomenon related to surface warming of the Pacific Ocean [14] The previous El Niño, in 1997–99, saw annual rises in CO_2 levels of 2 87 and 1 66 ppmv [15]

Prospects for reducing carbon emissions improved in late 2001 when more than 170 nations finalized the rules for the Kyoto Protocol at talks in Marrakesh, Morocco [16] For the protocol to enter into force it must be ratified by 55 countries representing 55 percent of the 1990 emissions of industrial and former Eastern bloc nations—called Annex I nations under the original Framework Convention on Climate Change [17] As of March 2002, 49 parties had ratified or acceded to the protocol, but they represented only 2 4 percent of Annex I emissions—as the Czech Republic and Romania are the only Annex I ratifiers thus far [18]

The United States, with 36 percent of the Annex I share, withdrew from the Kyoto negotiations in 2001, and in March 2002 announced a set of voluntary measures and incentives for energy efficiency and renewable energy [19] These steps represent more a continuation of previous policy than a new initiative, however, and are unlikely to restrain U S emissions growth

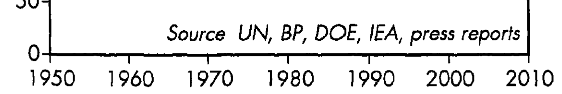
The U S absence implies that, for the Kyoto Protocol to become law, the EU, Russia, Japan, Australia, and Canada must all ratify the pact [20] In March 2002, EU environment ministers agreed to ratify the protocol by June and directed member state parliaments to ratify the treaty under national law, they also called on Japan and Russia to follow their lead [21] The governments of Denmark, France, Luxembourg, and Portugal have already approved ratification of Kyoto, other EU members stated their intent to do so by mid-June [22]

Carbon Emissions Reach New High



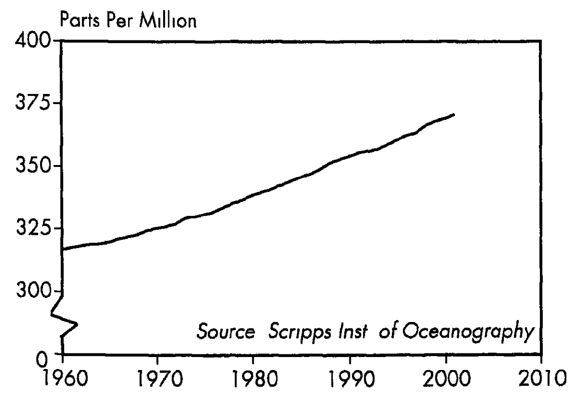
Source UN, BP, DOE, IEA, press reports

Figure 1 World Carbon Emissions from Fossil Fuel Burning, 1950–2001



Source UN, BP, DOE, IEA, press reports

Figure 2 Carbon Intensity of the World Economy, 1950–2001



Source Scripps Inst of Oceanography

Figure 3 Atmospheric Concentrations of Carbon Dioxide, 1960–2001

World Carbon Emissions from Fossil Fuel Burning, 1950–2001, and Atmospheric Concentrations of Carbon Dioxide, 1960–2001

Year	Emissions (mill tons of carbon)	Carbon Dioxide (parts per mill)
1950	1,612	n a
1955	2,013	n a
1960	2,535	316 7
1965	3,087	319 9
1970	3,997	325 5
1971	4,143	326 2
1972	4,305	327 3
1973	4,538	329 5
1974	4,545	330 1
1975	4,518	331 0
1976	4,776	332 0
1977	4,910	333 7
1978	4,962	335 3
1979	5,249	336 7
1980	5,177	338 5
1981	5,004	339 8
1982	4,959	341 0
1983	4,942	342 6
1984	5,113	344 2
1985	5,274	345 7
1986	5,436	347 0
1987	5,558	348 7
1988	5,774	351 3
1989	5,879	352 7
1990	5,939	354 0
1991	6,025	355 5
1992	5,922	356 4
1993	5,914	357 0
1994	6,050	358 9
1995	6,182	360 9
1996	6,327	362 6
1997	6,419	363 8
1998	6,401	366 6
1999	6,366	368 3
2000	6,480	369 4
2001 (prel)	6,553	370 9

Source Worldwatch estimates based on UN, BP, DOE, IEA, and press reports

CFC Use Declining

Molly O Sheehan

Global production of chlorofluorocarbons (CFCs), which harm Earth's protective ozone layer, fell by less than 1 percent between 1998 and 1999, the most recent year for which relatively complete data are available [1] (See Figure 1) CFCs were once widely used as coolants, aerosol propellants, and industrial solvents, and in foam insulation A 1987 treaty to protect the ozone layer initiated dramatic declines in CFC output, which is now many times below peak production years, the late 1980s [2]

China, India, and Russia produced the most CFCs in 1999 [3] (See Figure 2) Developing nations are the largest producers because the 1987 Montreal Protocol and its amendments banned CFC production in industrial nations as of 1996, except for a small volume for export to developing countries or for essential uses, such as asthma inhalers [4] One of the largest manufacturing plants in the industrial world, in the Netherlands, will close at the end of 2005 [5] All CFC production ceased in Russia in December 2000 [6] The Montreal Protocol requires developing countries to phase CFCs out by 2010 Many nations, including China and India, are receiving assistance from the treaty's Multilateral Fund to make this transition [7]

Link, p 114

Many CFCs were initially replaced by hydrochlorofluorocarbons (HCFCs), which are now being supplanted by hydrofluorocarbons because HCFCs harm the ozone layer too, albeit to a lesser extent [8] All fluorocarbons, however, are potent greenhouse gases, so some CFC alternatives bypass this family of chemicals altogether "Greenfreeze" refrigerators, for example, use hydrocarbons instead of fluorocarbons for coolant and insulating foam Some 55 million Greenfreeze refrigerators dominate markets in Western Europe [9] Prodded by Greenpeace, three major Japanese companies announced in late 2001 they would produce this type of refrigerator too [10]

The government of Canada estimates that only 5 percent of vehicle air conditioners there still used CFCs as of mid-2001 [11] In contrast, a U S survey in 2001 found that building owners were only nearing the halfway point in replacing chillers that use CFCs—and that it would take at least until 2010 to complete the conversion, much longer than expected [12] (The CFCs still used in this equipment are either recycled or obtained illegally)

Indeed, fed by production in developing countries, a black market is thriving in industrial nations where CFC-using appliances are still in use [13] Illegal exports from India and China have been growing [14] Since 1995, when the United States launched a national enforcement initiative, more than 100 people have been convicted of smuggling CFCs into the country [15]

Another threat to the ozone layer is that some chemicals originally touted as replacements to CFCs are not as benign as scientists hoped A scientific panel advised the treaty secretariat in October 2001 to ban n-propyl bromide, hexachlorobutadiene, Halon-1202, and 6-bromo-2-methoxy-napthalene [16] We cannot be complacent If enough of these new chemicals are manufactured, we will delay the recovery of the ozone layer quite significantly," warned Mario Molina, who shared the 1995 chemistry Nobel Prize for his work on ozone loss [17]

Although CFC production has declined steeply, the ozone layer has yet to recover, as these compounds take years to reach the upper atmosphere and last for decades or centuries once there In October 2001, researchers at the U S National Oceanic and Atmospheric Administration said the seasonal hole ' in the ozone layer above Antarctica appeared to have stabilized for the previous three years [18] In September 2001, satellite data showed that the geographic area covered by the ozone hole area was about the same as the year before [19]

Scientists in late 2000 predicted that the hole in the ozone layer should begin to close within a decade, healing completely by 2050 [20] Unfortunately, some damage has already been done skin cancer reportedly rose 66 percent between 1994 and 2001 in Punta Arena, Chile, the world's southernmost city [21]

CFC Use Declining

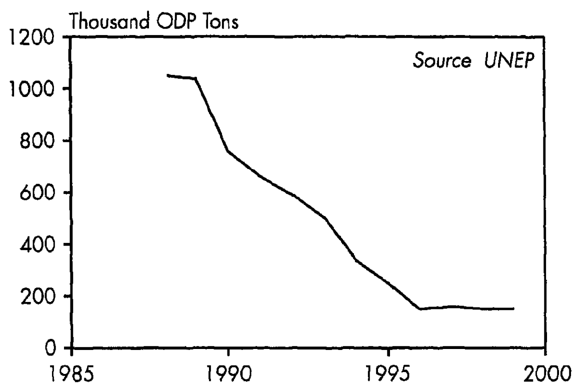


Figure 1 World CFC Production, 1986–99

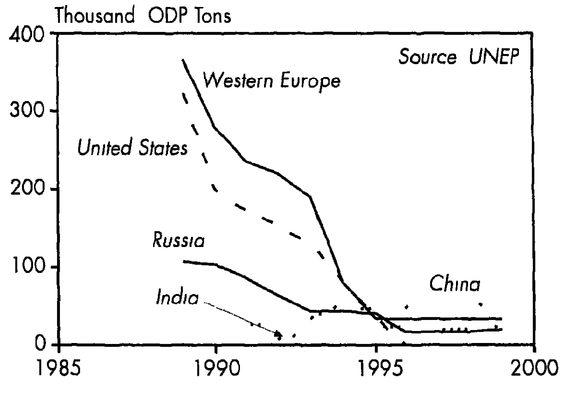


Figure 2 CFC Production by Country or Region, 1989–99

World CFC Production, 1986–99

Year	Production (thousand ODP tons)*
1986	1072 3
1989	1046 0
1990	764 3
1991	664 3
1992	590 8
1993	506 0
1994	338 5
1995	253 8
1996	151 6
1997	158 8
1998	146 9
1999	146 8

*These numbers reflect the volume of the major CFCs (CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115) multiplied by their respective ozone-depleting potentials (ODPs) The ODP value is the ratio of a given compound's ability to deplete ozone compared with the ability of a similar amount of CFC-11

Source Gerald Mutisya, UNEP Ozone Secretariat

Economic Trends

Economic Growth Falters
Trade Slows
Foreign Debt Falls in Dollar Terms
Metals Exploration Drops Sharply
Metals Production Climbs
Oil Spills Decline
Roundwood Production Rebounds

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Economic Growth Falters

David Malin Roodman

As it has every year for half a century, gross world product (GWP)—the tally of government estimates of the output of goods and services in nations around the world—reached a new high in 2001, at $45 9 trillion (in 2000 dollars) [1] (See Figure 1) But the rate of growth, 2 1 percent, was among the lowest since 1950 [2] (See Figure 2)

The current growth slowdown is the most widespread since the early 1980s, according to the International Monetary Fund [3] It was most marked in the Americas, with growth dropping from 4 1 percent in 2000 to 1 0 percent in 2001 in the United States and nearly the same in Latin America [4] For Western Europe, growth fell from 3 4 percent to 1 7 percent [5] For Asia (excluding republics of the former Soviet Union), the rate fell from 5 3 percent to 2 8 percent, as a true recession—"growth" of –0 4 percent—occurred in Japan [6]

Growth generally slowed less in poorer countries In China, the second-largest economy, it slipped from 6 1 percent to 5 6 percent [7] In India, the fourth-largest, it went from 6 0 percent to 4 4 percent [8] The deceleration was also less pronounced in Eastern Europe, where the rate declined from 3 9 percent to 2 7 percent, and in the former Soviet Union, where it went from 7 5 percent (the highest rate since 1973) to 6 0 percent [9] Growth accelerated slightly in Africa, from 3 2 percent to 3 6 percent [10]

Overall, though, the simultaneity of the slowdown illustrates the interconnectedness of the global economy One cause of the slowdown appears to be the rally in the world's oil markets during 2000, which sent crude prices above $30 per barrel late that year [11]

Another is the bursting of the great technology stock bubble [12] In the United States, the stock market peaked in total value on March 24, 2000, at about $14 5 trillion, but then lost nearly 30 percent in 12 months [13] This, too, was part of a global phenomenon London's FTSE 100 index fell 20 percent and Tokyo's Nikkei 225 plunged 34 percent [14] In retrospect, perhaps trillions of dollars invested in high-technology equipment and companies went to waste Had it been invested differently, the global economy might have grown faster in 2001

A final common cause is the terrorist attacks of September 11, 2001, and the war in Afghanistan—but preliminary analysis suggests that these effects were and will remain relatively minor at the global level [15] The U S economy had already slipped into recession six months before the attacks [16] The 1995 earthquake in Kobe Japan, killed more people than the 2001 terrorist attacks and did more property damage, but it had little long-term economic impact on Japan, let alone the world [17] The attacks could deal a lasting blow to global airline and hotel industries however and permanently raise the cost of international commerce

The growth rate of 2 1 percent seen in 2001 is rapid enough to double economic output every 30 years Yet many economists consider the world economy to be in recession when it grows less than 2 5 percent a year [18]

The global recession is bad news if it significantly slows economic development in poor countries While income per person has climbed steadily in the industrial west since World War II, reaching an average $29,000 in 2001, it has stayed far lower in many other countries [19] (See Figure 3) Yet cash income is one important source of economic well-being In poor countries, economic growth that is steady and shared by the broad mass of people is essential to development In Africa, average gross domestic product (GDP) per person has fluctuated around $1,700 since 1973 (in 2000 dollars) [20] A demonstration of the link between GDP and poverty came in 1998, when Indonesia's economy shrank 13 7 percent and its poverty rate reportedly climbed from 11 to 18 percent [21]

In rich countries, too, because of the way their economies work, the burden of recessions can fall on a small minority of people, often those least able to absorb the shock Companies are much more likely to cut costs by laying off, say, 5 percent of their workers than by cutting everyone's salary 5 percent In the United States, 1 8 million jobs disappeared in 2001 even while those looking for work expanded by 800,000—adding 2 6 million people to the ranks of the unemployed [22]

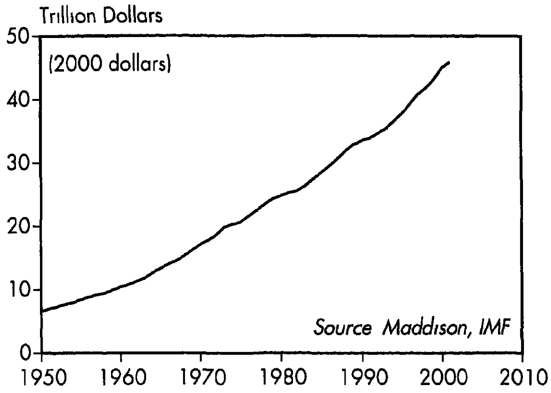


Figure 1 Gross World Product, 1950–2001

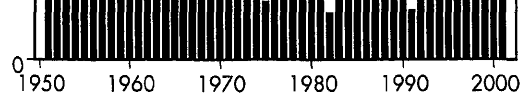


Figure 2 Growth of Gross World Product, 1951–2001

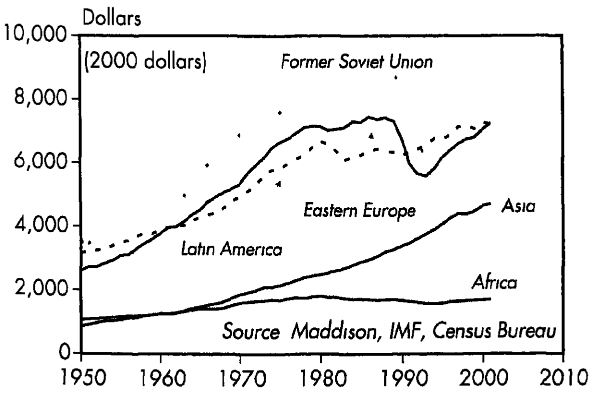


Figure 3 Gross Regional Product Per Capita, Selected Regions, 1950–2001

Gross World Product, 1950–2001

Year	Total (trill. 2000 dollars)	Per Person (2000 dollars)
1950	6.6	2,582
1955	8.5	3,042
1960	10.4	3,438
1965	13.3	3,980
1970	17.1	4,603
1971	17.8	4,697
1972	18.6	4,823
1973	19.9	5,041
1974	20.3	5,058
1975	20.6	5,038
1976	21.6	5,191
1977	22.5	5,308
1978	23.4	5,446
1979	24.3	5,542
1980	24.8	5,557
1981	25.2	5,567
1982	25.5	5,534
1983	26.3	5,595
1984	27.5	5,753
1985	28.4	5,853
1986	29.4	5,958
1987	30.5	6,069
1988	31.8	6,224
1989	32.8	6,316
1990	33.5	6,336
1991	33.9	6,314
1992	34.6	6,346
1993	35.3	6,384
1994	36.5	6,506
1995	37.7	6,633
1996	39.2	6,803
1997	40.8	6,976
1998	41.7	7,038
1999	43.0	7,167
2000	44.9	7,392
2001 (prel)	45.9	7,454

Sources: Worldwatch update of Angus Maddison, *The World Economy: A Millennial Perspective* (Paris: OECD, 2001), updates from IMF, *World Economic Outlook* tables

Trade Slows

David Malin Roodman

According to a preliminary estimate, the total value of world exports declined 4.1 percent in 2001—from $7.75 trillion the year before to $7.43 trillion (in 2000 dollars).[1] (See Figure 1.) This percentage drop is the largest since 1983.[2]

This drop in fact may be an underestimate, because it is based on incomplete data for late 2001, when ripple effects from the global economic slowdown and terrorist attacks began to spread. The fall in demand for jet fuel late in the year, for example, pushed down both the volume of oil exports, measured in barrels, and the price paid for each barrel, which doubly depressed the total value of oil exports.[3]

From an economic point of view, international trade occurs whenever a resident of one country sells something to a resident of another. The "something" can be a tangible good such as a barrel of oil or a car. It can also be an intangible service. When a Japanese hotel sells the use of a room for a night to a German tourist, that service counts as an export from Japan to Germany (even though the tourist traveled from Germany to Japan).

Links: pp. 30, 58, 126

International trade in goods has accelerated radically since 1950. Goods exported in 1950 were worth $380 billion (in 2000 dollars).[4] Fifty-one years later, that figure was reached every three weeks, and it totaled some $5.96 trillion for 2001 as a whole.[5]

Since 1970, exports growth for services has paralleled that for goods. From $310 billion in 1970, service exports climbed to $1.47 trillion in 2001 (in 2000 dollars).[6] Major categories of exported services in 1999 included freight (earning $134 billion), passenger transport ($83 billion), and other travel-related services ($437 billion).[7]

The ratio between the value of world trade and the value of total economic production (gross world product, or GWP) is one indicator of "globalization." Since World War II, this ratio has climbed overall. But since 1995 it actually has fallen, from a peak of 18.4 percent to 15.9 percent.[8] (See Figure 2.) Between 1996 and 1998, prices for traded goods fell 12 percent on average—rather than rising with general inflation in the U.S. dollar—mainly because of the currency crises in East Asia.[9] Prices then recovered, but the global economic slowdown took hold and reduced the physical volume of goods exports.[10]

In November 2001, diplomats met in Doha, Qatar, to launch a new round of negotiations to reduce restrictions on world trade. The previous round had lasted six years and concluded in 1994 with the creation of the World Trade Organization (WTO). If the new round indeed gets off the ground, it will be the ninth since World War II, and the most controversial yet.[11]

Especially in rich countries, many people are concerned about the way the WTO system tends to put the cause of trade liberalization ahead of important concerns such as ecological stability, protection of workplace safety standards, and human rights. In 1991, for example, the WTO ruled against a U.S. import ban on tuna caught with dolphin-ensnaring nets.[12] The law may have been good for the environment, but it was deemed harmful to trade.

At least as potent at Doha was skepticism from developing countries.[13] Historically, the United States, Western Europe, and Japan have muscled through rules that benefit their own companies more than those of poorer countries.[14] Notably, at Doha, developing countries united more than they had before, enough to extract major rhetorical concessions from richer countries.

Industrial countries promised to phase out their subsidies for agricultural exports, which glut global food markets, lower prices, and harm farmers in poor countries.[15] Delegates also endorsed a declaration stating that public health emergencies can take precedence over protecting the intellectual property of pharmaceutical companies.[16] That may make it easier for developing-country governments to break drug patents in order to obtain cheaper, copycat drugs to fight malaria, tuberculosis, and AIDS. But it will be years before negotiators hammer out what all these concessions mean in practice.

Trade Slows

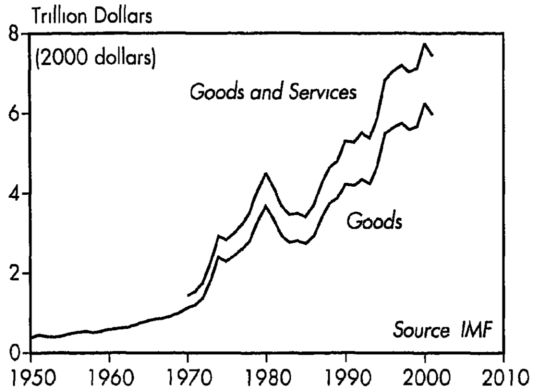


Figure 1 World Exports of Goods 1950–2001, and Goods and Services, 1970–2001

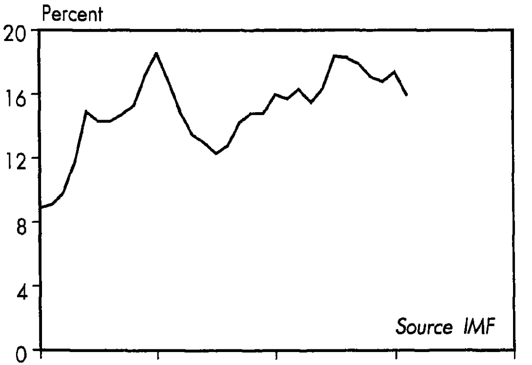


Figure 2 World Exports of Goods and Services as a Share of Gross World Product, 1970–2001

World Exports of Goods, 1950–2001, and Goods and Services, 1970–2001

Year	Goods	Goods and Services
	(trill 2000 dollars)	
1950	0 38	
1955	0 49	
1960	0 60	
1965	0 81	
1970	1 14	1 45
1971	1 21	1 54
1972	1 38	1 74
1973	1 81	2 26
1974	2 40	2 93
1975	2 29	2 84
1976	2 44	3 00
1977	2 61	3 22
1978	2 82	3 51
1979	3 30	4 07
1980	3 67	4 50
1981	3 34	4 13
1982	2 93	3 68
1983	2 76	3 45
1984	2 82	3 49
1985	2 74	3 42
1986	2 94	3 70
1987	3 38	4 25
1988	3 74	4 64
1989	3 87	4 80
1990	4 22	5 23
1991	4 19	5 26
1992	4 35	5 51
1993	4 24	5 38
1994	4 69	5 90
1995	5 49	6 83
1996	5 64	7 05
1997	5.75	7 13
1998	5 58	7 02
1999	5 67	7 12
2000	6 25	7 75
2001 (prel)	5 96	7 43

Source IMF, *International Financial Statistics*, electronic database, November 2001, IMF, *World Economic Outlook Database*, December 2001

Foreign Debt Falls in Dollar Terms

David Malin Roodman

In 2000, the cumulative foreign debt of developing and former Eastern bloc nations posted its largest one-year drop in dollar terms since detailed recordkeeping began in 1970[1] The fall from $2 62 trillion to $2 53 trillion (in 2000 dollars) followed a smaller decline in 1999[2] (See Figure 1)

The drops over these two years may be statistical aberrations, however At least 36 percent of the debt is owed in currencies other than dollars[3] As many of those currencies fell against the dollar in 1999 and 2000, loans denominated in them shrank in the dollar-based statistics[4] As a result, even as total debt fell in dollar terms, it rose when expressed in euros, the second-most-used currency for loans to these countries—from 2 27 trillion to 2 69 trillion (in 2000 euros)[5] Overall, the debt total is best seen not as having fallen, but as having reached a standstill after a long climb

Link p.118

Since loans are investments, whether high debt is good or bad for a country hinges on how well the money is used Ideally, it supports projects—from public railroad construction to education—that ultimately boost economic output, and exports earn enough to repay the loans In South Korea, for example, foreign lending has helped finance rapid economic development and poverty reduction[6]

Worldwide, however, foreign funds have often been used poorly—supporting arms purchases, corruption, capital flight, and prestige projects (such as unneeded airports), in addition to more well-intended but poorly implemented projects[7] This is one reason that countries have frequently fallen into debt trouble in recent decades, becoming unable to meet their repayment obligations Herd mentality of investors is another

Developing and former Eastern bloc countries divide roughly into two groups, based on the kind of debt trouble they are prone to Middle-income countries are industrialized enough to attract serious interest from commercial creditors—bond investors and banks—and consequently borrow most heavily from them[8] These countries accounted for 78 percent of the outstanding debt of developing and former Eastern bloc nations at the end of 1999[9]

Middle-income countries have been struck by major debt crises at remarkably regular intervals of about 50 years since the 1820s[10] (See Figure 2) The most recent one hit in 1982, and sent many nations, including most of South America, into recession for nearly a decade In Mexico, wages fell by half between 1982 and 1988[11] In the Philippines, a million or more desperate peasants moved into the hills, where they cleared erodible slopes of protective trees and started farming to survive[12] The last decade has seen crises in Argentina, Brazil, Ecuador, East Asia, Mexico, and Turkey

The other debtor group consists of low-income countries such as Nicaragua and Tanzania Generally shunned by commercial lenders, they borrow mainly from rich-world governments and other official institutions such as the World Bank and the International Monetary Fund[13] Official creditors barely existed before World War II Much more than commercial lenders, they are generally willing to keep lending to countries in debt trouble even if most new loans just go toward repaying old ones Partly as a result, a historically novel form of debt trouble began to afflict many low-income countries by the 1980s—not so much crises as chronic syndromes in which new loans went largely to repaying old[14]

Rich-world governments have enacted a series of programs since the late 1980s to reduce the debt burden on low-income countries, but the inadequacy of each has been implicitly acknowledged by the launch of the next[15] At the end of 1999, 47 countries—37 in Africa—met the World Bank's statistical criteria for being low in income and high in debt[16] Of these, 42 are eligible for the latest program, the Heavily Indebted Poor Countries (HIPC) initiative, which offers by far the most debt relief to date—as much as 55 percent on average for eligible countries[17]

But even after the current HIPC program, many poor countries will probably owe more than they can pay[18] Thus creditors are likely to bring forth yet another program to address the debt troubles of the poorest nations

Foreign Debt Falls in Dollar Terms

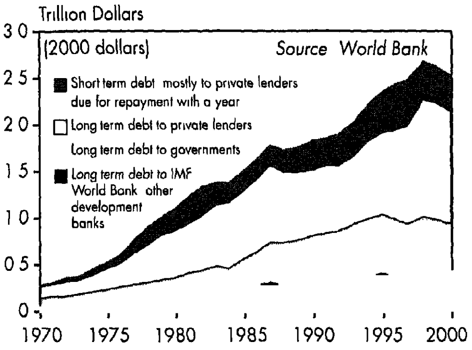


Figure 1 Foreign Debt of Developing and Former Eastern Bloc Nations, 1970–2000

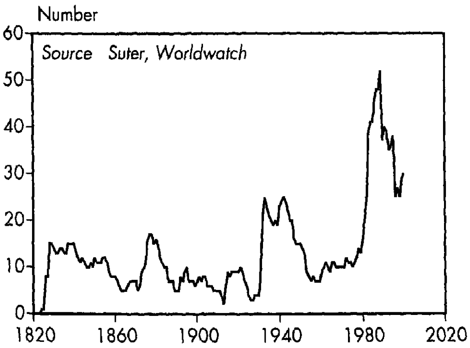


Figure 2 Number of Countries Not Servicing All Their Foreign Debts, 1820–2000

Foreign Debt of Developing and Former Eastern Bloc Nations, 1970–2000

Year	Foreign Debt (trill 2000 dollars)
1970	0 27
1971	0 29
1972	0 33
1973	0 38
1974	0 43
1975	0 52
1976	0 60
1977	0 75
1978	0 88
1979	1 00
1980	1 10
1981	1 20
1982	1 31
1983	1 36
1984	1 38
1985	1 50
1986	1 61
1987	1 77
1988	1 72
1989	1 74
1990	1 81
1991	1 85
1992	1 89
1993	2 02
1994	2 19
1995	2 35
1996	2 40
1997	2 45
1998	2 66
1999	2 62
2000	2 53

Source World Bank, *Global Development Finance*, electronic database, 2001

Metals Exploration Drops Sharply

Payal Sampat

In 2001, mining companies spent just under $2 billion exploring for untapped lodes of metal around the world[1] (See Figure 1) This is less than half the amount spent in 1997—a record $4 2 billion[2] Bruised by the lingering effects of the 1998 Asian financial crisis, low metals prices, and capital shortages, most mining companies have shrunk their exploration budgets and cut operating costs at existing mines[3]

Gold has traditionally driven exploration budgets in 1997, two thirds of all exploration was for this yellow metal[4] But gold prices have dropped by half since 1990 (in 2000 dollars), reaching a 29-year low in 2001 and driving the share of exploration for gold down to 42 percent[5] Metals such as copper, zinc, and nickel accounted for a greater share of exploration budgets in 2001 than they have in the past, almost 39 percent[6]

Links pp 66, 112

As the quest for new veins of metal accelerated in the mid-1990s, most new exploration took place in the developing world Between 1991 and 1997, exploration spending expanded six times in Latin America and almost quadrupled in the Pacific region[7] Although spending on exploration has plummeted dramatically in all regions since then, the developing world still attracts about half of all new money[8] Latin America remains a leading attraction, drawing 28 percent of investment in 2001[9] (See Figure 2) Chile, Peru, Brazil, and Mexico—all of which have courted foreign investors in the last 10 years—lead the list for this region[10]

Southeast Asia and the Pacific has seen a 72-percent decline in investment, although multinational firms continue to operate and expand existing mines in Indonesia, Papua New Guinea, and other island nations[11] Mining companies are keen to expand their presence in Africa—which claimed only 14 percent of all spending in 2001—in the quest for diamond and platinum deposits[12]

The more wealthy mining regions—where most mining companies are headquartered—still maintain a strong foothold Australia and Canada, the nations that attracted the most investment in 2001, each accounted for 17 percent of exploration spending[13] The U S share, however, shrunk to just 8 percent—exploration there fell 60 percent between 1997 and 2001[14] This cutback came in response to changes in U S mining laws in 2000 but many of the new environmentally favorable rules have since been revised or rolled back[15]

Although metals serve many useful purposes, the extraction and processing of virgin minerals can impose a sobering toll on people and ecosystems Most new mining development is taking place in some of the world's most ecologically fragile regions—many of which are located in poor countries desperate for foreign investment These include a titanium mine in a Madagascar forest that is inhabited by rare lemurs, birds, and 20 indigenous plant species, gold exploration in Perus Andean cloud forests, and tantalite mining in the Okapi Reserve in the Democratic Republic of Congo, home to the endangered mountain gorilla[16]

Several studies point out that mining-dependent nations typically have sluggish rates of economic development and some of the highest poverty rates, spurring a debate about whether mining benefits poor people and countries over the long term[17] One thing seems clear the poor tend to bear the costs of mining disproportionately Perhaps as much as 50 percent of gold produced between 1995 and 2015 has or will come from indigenous peoples' lands in places as diverse as Nevada and Papua (formerly Irian Jaya)[18] In Peru, local farmers have protested being displaced by the Tambo Grande mines, communities in Guyana, Papua New Guinea, and Kyrgyzstan, among others, have suffered as mines there have severely contaminated soil and water supplies[19]

The International Labour Organization calls mining one of the most hazardous occupations It employs just 1 percent of the global work force but is responsible for 5 percent of all worker deaths on the job—about 40 deaths a day[20] As mining companies try to reduce operating costs, jobs in mining are in further decline In 1999 alone, South African mines laid off about 100,000 workers—a third of the total—as operations were mechanized or closed[21]

Metals Exploration Drops Sharply

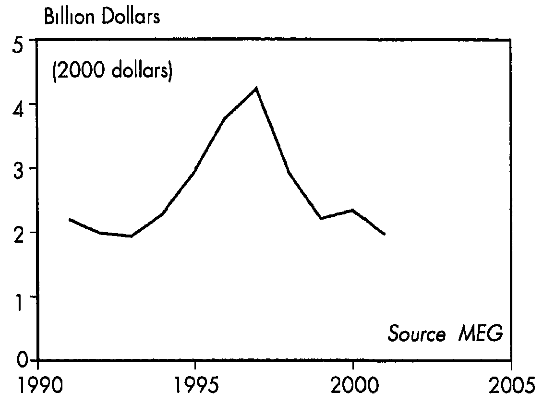


Figure 1 World Metals Exploration Investment, 1991–2001

World Metals Exploration Investment, 1991–2001

Year	Investment (million 2000 dollars)
1991	2,203
1992	1,980
1993	1,934
1994	2,284
1995	2,933
1996	3,771
1997	4,230
1998	2,933
1999	2,212
2000	2,338
2001	1,966

Source MEG, *Strategic Reports*, 1991–93, and press releases, 1994–2001

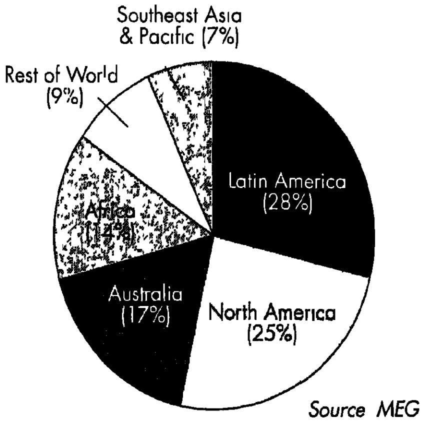


Figure 2 Share of World Metals Exploration Investment by Region, 2001

Metals Production Climbs

Payal Sampat

More than 900 million tons of metals were extracted from the earth in 2000—about 7 percent more than the previous year [1] (See Figure 1) In the last 30 years, a total of 24 billion tons of metals have been mined [2] If this material were loaded onto the largest, 218-ton dump trucks that are used on mine sites, the convoy of trucks lined bumper-to-bumper could circle the globe at the Equator 34 times [3]

Where does this enormous amount of material go once it is removed from the ground? Most of it works its way into our daily lives, forming buildings, bridges, cars, airplanes, stereos, cell phones, and other goods Some materials, such as steel in buildings, remain in use for decades, others, such as aluminum cans, may be discarded minutes after use

Links pp 60, 64, 84, 112

About 70 metals are mined for commercial use, including aluminum, cadmium, copper, lead, nickel, raw steel, and zinc By weight, steel accounts for the bulk of the total—nearly 94 percent [4]

On average, 148 kilograms of metal were produced per person in 2000 [5] (See Figure 2) This is significantly smaller than the all-time high of 185 kilograms per person in 1973 [6] The decline reflects the expansion in global population in the last three decades, much of which has taken place in poorer regions, where materials consumption per person is relatively low

The metals intensity of the global economy—the amount of metals used to generate economic wealth—has declined 45 percent in the last 30 years [7] (See Figure 3) This reflects a shift in the global economy as manufacturing and other industries that typically use large amounts of metal have grown at a far slower pace than service industries such as telecommunications and finance

Mineral ores are unevenly distributed in Earth's crust, with some concentrated in a few regions One third of the world's copper is extracted in Chile, for instance, while 28 percent of lead comes from China [8] Metals are often produced in countries that are major consumers as well [9] China, for example, is the world's largest producer and consumer of steel, while the United States produces and uses more aluminum than any other country [10] Elsewhere, metals are extracted almost entirely for export—with even the ores sent overseas for processing and refining For instance Papua New Guinea and Botswana mine copper ores, but most of the output is exported to non-copper-producing countries such as South Korea and Germany to be refined [11]

The major industrialized regions—the United States, Canada, Australia Japan, and Western Europe—with 15 percent of the world's population, together consume 61 percent of all aluminum, 60 percent of lead, 59 percent of copper, and 49 percent of steel [12] On a per capita basis, the different levels of consumption are especially marked the average American uses 22 kilograms of aluminum a year, while the average for India is 2 kilograms, and for Africa, just 0 7 kilograms [13]

For countries that are major importers or exporters of finished goods the per capita figure may mask or overstate domestic metals use For example, Taiwan and South Korea rank much higher than any industrial country in their copper consumption, at 29 kilograms and 18 kilograms per person [14] But most of this feeds their large export markets for electronics and other goods

Just a few sectors of the economy dominate metals use In industrial countries, the transportation sector (including vehicle fleets) uses an estimated 70 percent of lead produced each year, 37 percent of steel, 33 percent of aluminum, and 27 percent of copper [15] Construction is another major player, using 34 percent of steel, 30 percent of copper, 17 percent of lead, and 19 percent of aluminum in industrial nations [16]

It takes far less energy to mine discarded materials than to extract, process, and refine metals from ore It takes 95 percent less energy to produce aluminum from recycled materials, for example, than from bauxite ore [17] Recycling copper takes seven times less energy than processing ore, recycled steel uses three-and-a-half times less [18] Globally, 29 percent of aluminum and 13 percent of copper come from recycled sources [19]

Metals Production Climbs

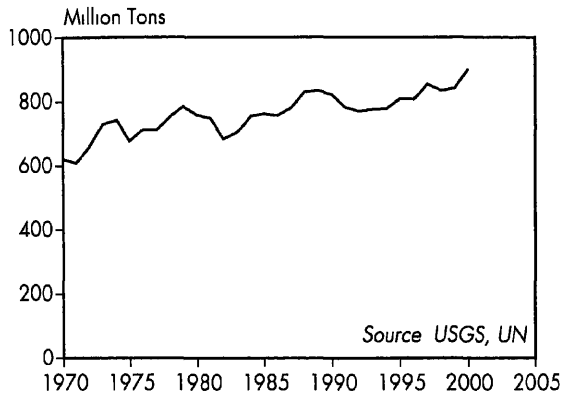


Figure 1 World Metals Production, 1970–2000

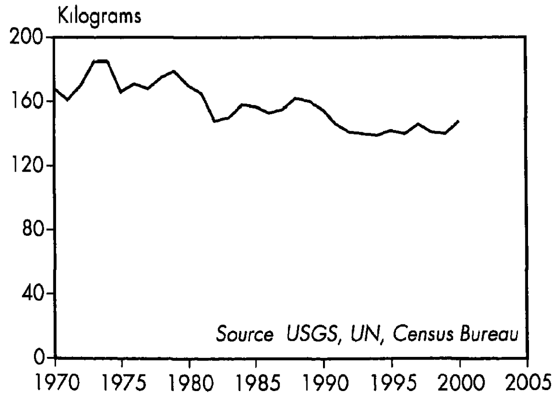


Figure 2 World Metals Use Per Person, 1970–2000

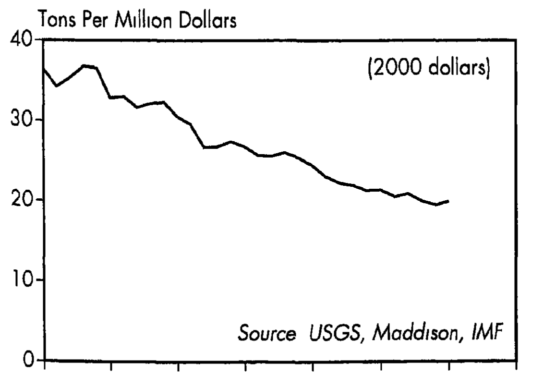


Figure 3 Metals Intensity of Global Economy, 1970–2000

World Metals Production, 1970–2000

Year	Metals Mined (million tons)
1970	621
1971	609
1972	658
1973	730
1974	742
1975	677
1976	712
1977	711
1978	753
1979	785
1980	757
1981	748
1982	682
1983	703
1984	754
1985	761
1986	756
1987	780
1988	828
1989	833
1990	820
1991	782
1992	771
1993	775
1994	778
1995	808
1996	806
1997	854
1998	834
1999	841
2000 (prel)	902

Sources USGS, *Minerals Yearbook* and *Mineral Commodity Summaries*, various years, United Nations, *Industrial Commodities Statistics Yearbook*, various years

Oil Spills Decline

Michael Renner

The amount of oil spilled accidentally in 2000 from tankers, pipelines, wells, storage facilities, and other sources was estimated at 48,600 tons worldwide by the *Oil Spill Intelligence Report* (OSIR).[1] This was the lowest recorded since 1968. The largest amount, some 1.5 million tons, was spilled in 1979.[2] Since 1990, there has been an almost continuous reduction in the quantity of oil spilled.[3] (See Figure 1.)

These figures do not include spills that are the result of warfare or sabotage, however. Historically, three of the top five spill incidents are the result of acts of war.[4] (See Figure 2.) Attacks on oil fields and tankers during the Iran-Iraq war raised the total for 1983 by 46 percent.[5] In 1991, Iraqi troops deliberately released some 840,000 tons of oil from Kuwaiti facilities into the Persian Gulf, causing the largest marine oil spill in history.[6] And in 2000, reports of sabotage by Chechen rebels indicated that 2 million tons of oil had leaked from wells and refineries near Grozny.[7] If confirmed, this would be the largest spill ever.

Links: pp. 38, 94

From 1968 to 2000, there were more than 7,600 civilian incidents with about 10.6 million tons of oil spilled.[8] More than 400 war-related incidents added at least another 3.6 million tons.[9] The top 50 oil spills—just 6 percent of all incidents—account for more than half the total spillage since 1968.[10]

Oil tankers, the leading source of spills, transport some 107 million tons of oil on an average day.[11] OSIR and the International Tanker Owners Pollution Federation provide somewhat conflicting spill data for certain years.[12] (See Figure 3.) In 1968–2000, tankers, barges, and other vessels accounted for about half the total amount of oil spilled.[13] But greater use of double-hulled tankers and other safety measures have significantly reduced both the number of tanker accidents and the quantity of oil spilled.[14]

Collisions and groundings are relatively rare, but can result in large, sometimes massive, spills. The two largest tanker accidents happened off the coast of South Africa, when the *Castillo de Bellver* lost 267,000 tons in 1983, and off Brittany, France, when the *Amoco Cadiz* disgorged 234,000 tons in 1978.[15] The infamous 1989 *Exxon Valdez* incident in Alaska ranks only as the forty-second worst tanker accident in terms of quantity of oil released, although it occurred in a particularly pristine and ecologically vulnerable location.[16]

Almost half of all pipeline spills are the result of aging equipment. Some pipelines are 30–50 years old, others are even older.[17] Niger delta communities in Nigeria have suffered heavily from spills caused by corrosion of antiquated pipelines and by vandalism. Pipeline bursts have killed hundreds of people in recent years.[18]

Sabotage is another cause of pipeline spills. In the last few years rebel groups have attacked pipelines in Algeria, Assam (India), Colombia, Ecuador, Sudan, Turkey, and Yemen.[19] In Colombia, rebel groups bombed pipelines 98 times during 2000, up from 79 times during 1999.[20] Unconfirmed estimates suggest that about 43,000 tons of oil were spilled there in 2000—twice the amount lost due to all non-war pipeline incidents that year.[21]

Some well blowouts are among the biggest spills ever. From June 1979 to February 1980, for example, the Ixtoc exploratory well in the Gulf of Mexico spewed some 476,000 tons of oil, the largest non-war oil spill ever.[22] A production well in Uzbekistan's Fergana Valley spilled 299,000 tons in 1990, and one in Libya lost 143,000 tons in 1980.[23]

The quantity of oil spilled does not necessarily indicate the severity of the impact on the environment. Important factors include the type of oil spilled, weather and climate conditions, the extent to which the oil is recovered or at least contained, how quickly the oil biodegrades and how much of it evaporates, and the proximity to wildlife habitats or environmentally sensitive areas.[24]

Even though much of the oil released by the *Exxon Valdez* in 1989 evaporated or dispersed, for instance, the accident had disastrous results.[25] It killed an estimated 3,500–5,500 sea otters (10–15 percent of the region's total population) and some 300,000–675,000 seabirds.[26] Most wildlife species still have not recovered

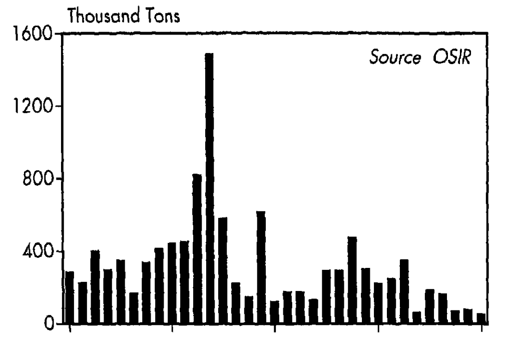


Figure 1 Oil Spills from Civilian Operations, 1968–2000

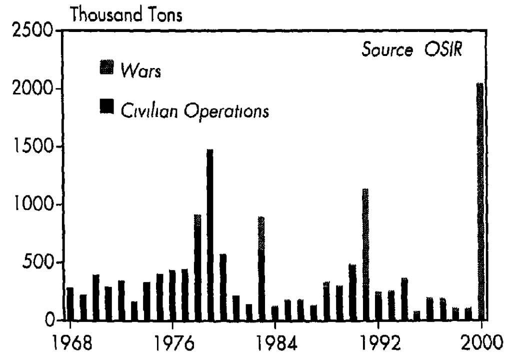


Figure 2 Oil Spills from Civilian Operations and Wars Combined, 1968–2000

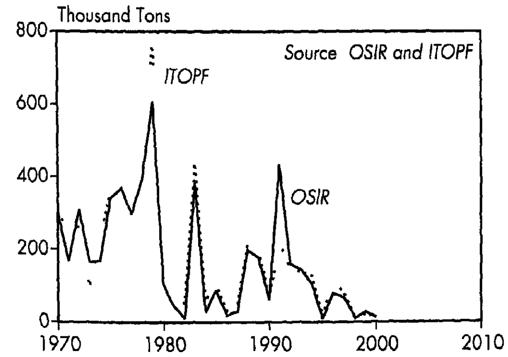


Figure 3 Tanker Oil Spills, 1970–2000

Oil Spills from Civilian Operations, 1968–2000

Year	Oil Spilled (thousand tons)
1968	283 4
1969	226 3
1970	399 9
1971	295 9
1972	346 2
1973	164 8
1974	336 3
1975	410 3
1976	439 6
1977	450 7
1978	816 8
1979	1,481 3
1980	577 9
1981	220 8
1982	146 3
1983	614 6
1984	120 8
1985	174 2
1986	173 3
1987	128 3
1988	290 2
1989	291 9
1990	474 4
1991	298 5
1992	218 9
1993	244 0
1994	347 7
1995	60 2
1996	183 3
1997	160 6
1998	68 2
1999	74 9
2000	48 6

Source Oil Spill Intelligence Report

Roundwood Production Rebounds

Janet N Abramovitz

According to the U N Food and Agriculture Organization (FAO), global production of roundwood—the logs that become fuel, lumber, paper, and other wood products—reached a new peak of 3,376 million cubic meters in 1999, the last year for which data are available [1] (See Figure 1) Production has topped 3,000 million cubic meters every year since 1983, more than twice the figure in 1950 [2] In the mid-1990s the global total dipped as production in the former Soviet Union fell by about two thirds during the new countries' economic transition [3]

In 1999, 61 percent of the world's recorded wood harvest came from developing nations [4] The share produced in industrial nations has declined from 57 percent in 1961 to 39 percent in 1999 [5] (See Figure 2)

About 55 percent of the roundwood cut today is used directly for fuelwood and charcoal [6] The other 45 percent becomes "industrial roundwood"—the logs that are cut into lumber and panels for construction purposes or ground into pulp to make paper [7] Developing countries produce about 89 percent of wood cut specifically for fuel [8] But these figures are misleading in terms of the importance of wood fuel in industrial countries where there are large forest products industries, by-products such as wood chips and sawdust are burned to fuel the mills These add close to 300 million cubic meters of wood to the 173 million used directly for fuel in industrial countries [9]

Link p 104

The industrial roundwood harvest has remained concentrated in just five countries since the 1970s the United States, Canada, Russia, China, and Brazil These five produce 58 percent of the world's recorded production Together the top 10 (adding in Sweden, Finland, Germany, France, and Indonesia) accounted for about 72 percent of production [10]

Industrial nations produce 73 percent of industrial roundwood, a share that has declined since 1970 as developing nations expanded their output [11] While production in industrial nations has remained relatively constant since 1970, in developing nations it has doubled [12] Industrial nations continue to consume a disproportionate share of global production—77 percent of the timber harvested for industrial use is consumed by the 22 percent of the world living in industrial nations [13] Although the United States uses the most, China is now second [14]

Production of some industrial wood products has grown more rapidly than others Between 1961 and 1999, paper production grew by 309 percent [15] Paper and paperboard now account for the largest single share of industrial wood use, at 40 percent, through wood cut directly for paper and the use of residues from other wood processing mills [16] Sawnwood, the lumber used for construction and furniture, dropped from 34 percent of production in 1961 to 27 percent in 1999 [17] Total sawnwood production increased by only 18 percent since 1961, and has declined from peak production in the late 1980s [18] (See Figure 3) Production of wood panels like plywood (which have replaced sawnwood in some cases) jumped 545 percent since 1961 now accounting for 11 percent of production [19]

Due to illegal production and trade, output data are reported by governments to the FAO and may not reflect full levels of production In Indonesia, for example, an independent study by the U K Department for International Development found that production was more than double the amount reported by the government [20] Extensive illegal harvest and trade have also been reported in Brazil, Russia, Cambodia, Liberia, Papua New Guinea, Cameroon, and elsewhere [21] Growing recognition of this widespread problem is beginning to spur government commitments to combat illegal logging and trade [22]

The area of commercial forest certified as well-managed has grown substantially in recent years By the end of 2001, over 25 million hectares had been certified to Forest Stewardship Council (FSC) standards, more than double the area in 1998 [23] While there are FSC-certified forests in 54 countries, 67 percent of the acreage is in Europe and 13 percent is in North America [24] Wood products originating in well-managed forests are still only a small share of the market

Roundwood Production Rebounds

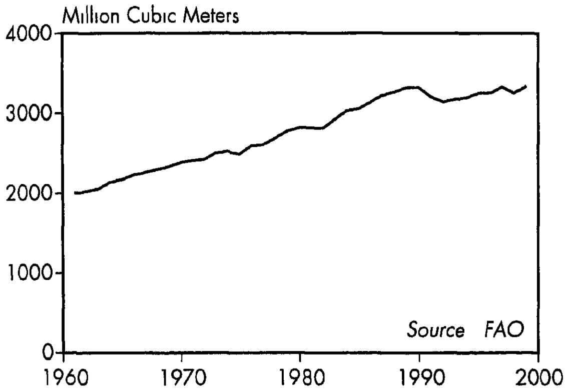


Figure 1 World Roundwood Production, 1961–99

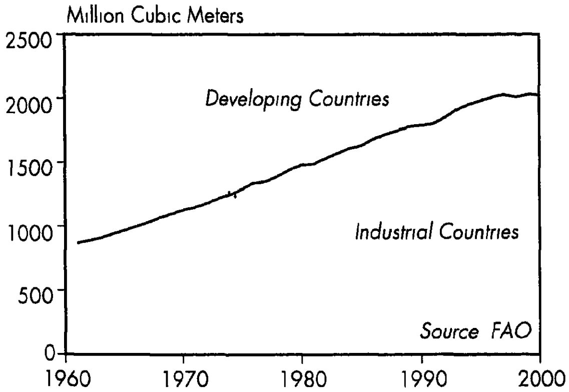


Figure 2 World Roundwood Production, Industrial and Developing Countries, 1961–99

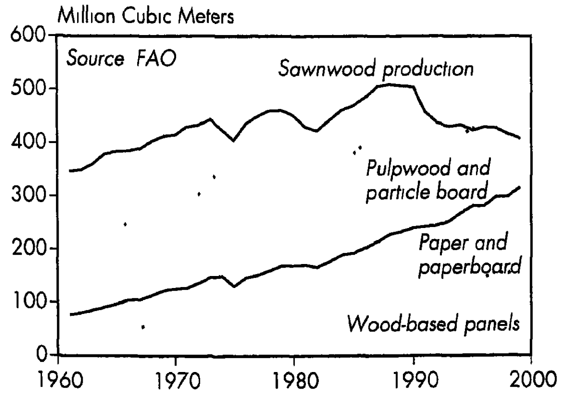


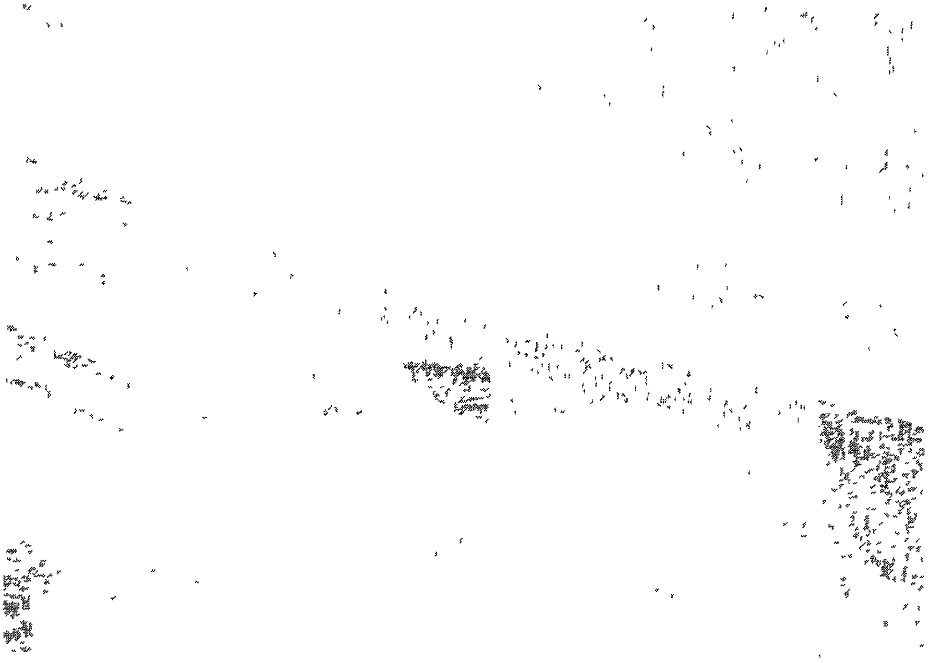
Figure 3 World Industrial Roundwood Production, by Type, 1961–99

World Roundwood Production, 1961–99

Year	Production (million cubic meters)
1961	2,000
1962	2,023
1963	2,055
1964	2,137
1965	2,168
1966	2,223
1967	2,254
1968	2,293
1969	2,330
1970	2,381
1971	2,407
1972	2,418
1973	2,502
1974	2,520
1975	2,486
1976	2,591
1977	2,608
1978	2,689
1979	2,776
1980	2,818
1981	2,817
1982	2,813
1983	2,921
1984	3,030
1985	3,053
1986	3,137
1987	3,224
1988	3,270
1989	3,321
1990	3,320
1991	3,201
1992	3,140
1993	3,170
1994	3,193
1995	3,250
1996	3,254
1997	3,328
1998	3,251
1999	3,336

Source FAO, *FAOSTAT Statistics Database*, at <app fao org>, updated 7 November 2001

Transportation Trends



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Vehicle Production Declines Slightly

Bicycle Production Rolls Forward

Passenger Rail at Crossroads

Vehicle Production Declines Slightly

Michael Renner

According to DRI-WEFA Global Automotive Group estimates, global passenger car production declined 2 7 percent in 2001, to 40 million units[1] (See Figure 1) Light truck production also declined slightly, to 15 million[2] Global passenger car production outpaced sales by about 1 3 million vehicles, but sales of light trucks surpassed production by about 1 7 million[3] The global passenger car fleet grew to 555 million in 2001[4] (See Figure 2)

The global auto industry continues to suffer from substantial overcapacity Analysts at PricewaterhouseCoopers estimated global capacity to manufacture passenger cars and light trucks in 2001 at 77 3 million units, but only about 70 percent of capacity is in use[5] At 78 percent, capacity utilization in North America and Western Europe is far higher than elsewhere[6]

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After shedding weight in the 1980s, cars have gotten heavier again in the 1990s, even though manufacturers made increasing use of light materials like plastic and aluminum A typical U S family vehicle weighed 1,619 kilograms (kg) in 1978 and then 1,424 kg in 1990, but 1,501 kg in 2001[7] The motor vehicle industry's appetite for materials remains considerable, although at least 75 percent of a car's material content ends up being recycled[8] In the United States, the industry accounted for 33 percent of aluminum use in 2000, up from 17 percent in 1991[9] In recent years, the industry has accounted for 70–80 percent of U S natural rubber consumption, 65–77 percent of lead, 55–64 percent of synthetic rubber, one third of iron, 23 percent of zinc, about 15 percent of steel, and 12 percent of copper[10]

The industry also uses substantial amounts of energy, but far more is consumed in operating vehicles than in manufacturing them Advances in fuel efficiency would have led to reduced gasoline consumption from car use had it not been for a variety of offsetting trends such as larger cars and more powerful engines, an ever expanding car fleet, and continuous growth in distances traveled

The United States has slightly more than one quarter of the world's passenger cars[11] The fuel economy of new cars improved from just 14 2 miles per gallon (equivalent to 16 6 liters per 100 kilometers) in 1974 to 28 8 miles per gallon in 1988[12] But instead of additional progress, there has been some backsliding since then[13] The combined fuel economy of new passenger cars and light trucks reached a high of 26 7 miles per gallon in 1987, but now stands at just 24 7, the second-lowest figure in 20 years[14]

Since the mid-1980s, fuel efficiency has leveled off or declined in most other industrial countries as well[15] But fuel economy in Europe (particularly in France and Italy) and Japan remains higher than in the United States, where the popularity of light trucks makes improved efficiency an elusive target[16] (See Figure 3) Because European and Japanese fuel economy tests use tougher methods, their results may actually be as much as 18 percent lower than they would be in the United States[17]

Since the late 1990s, fresh gains in fuel economy have been achieved[18] In Japan, regulations will likely bring about a rise to about 35 miles per gallon (6 7 liters per 100 kilometers) for new models by 2010[19] The European Automobile Manufacturers Association has offered a voluntary commitment to reach 41 miles per gallon by 2008[20]

Even though a recent U S National Academy of Sciences panel found that fuel economy could be raised 16–47 percent over the next 10–15 years, U S carmakers show little interest[21] Steven Plotkin of the Argonne National Laboratory expects U S fuel economy to be no higher than 25 6 miles per gallon by 2010[22] A program initiated in 1993 to develop 80-miles-per-gallon cars by 2004 fell short of expectations It was abandoned by the Bush administration in early 2002 in favor of pursuing hydrogen-based fuel cell cars—which is unlikely to bear fruit for 10–20 years[23]

Hybrid gas-electric vehicles occupy only a tiny market niche so far, although they get easily twice the fuel economy of a standard car Toyota is planning to produce 300,00 hybrids a year by 2005, less than 1 percent of current car production[24]

Vehicle Production Declines Slightly

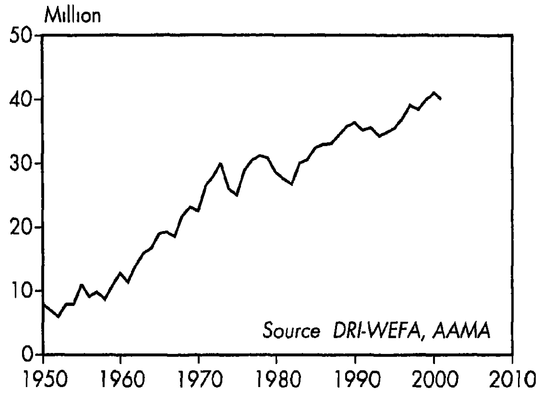


Figure 1 World Automobile Production, 1950-2001

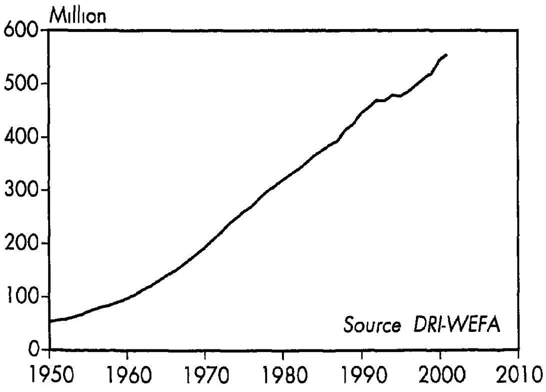


Figure 2 World Passenger Car Fleet, 1950-2001

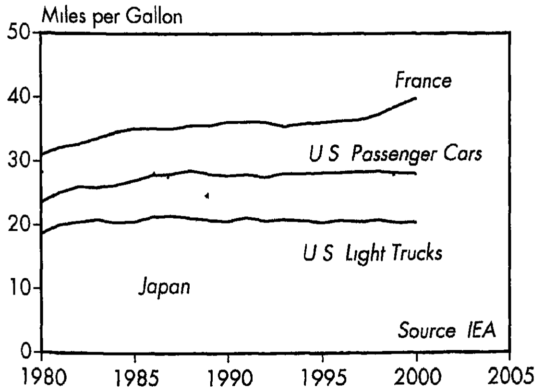


Figure 3 New Car Fuel Economy, Selected Industrial Countries, 1980–2000

World Automobile Production, 1950–2001

Year	Production (million)
1950	8.0
1955	11.0
1960	12.8
1965	19.0
1970	22.5
1971	26.5
1972	27.9
1973	30.0
1974	26.0
1975	25.0
1976	28.9
1977	30.5
1978	31.2
1979	30.8
1980	28.6
1981	27.5
1982	26.7
1983	30.0
1984	30.5
1985	32.4
1986	32.9
1987	33.1
1988	34.4
1989	35.7
1990	36.3
1991	35.1
1992	35.5
1993	34.2
1994	34.8
1995	35.5
1996	36.9
1997	39.1
1998	38.4
1999	39.9
2000	41.1
2001 (prel)	40.0

Sources DRI-WEFA Global Automotive Group, American Automobile Manufacturers Association

Bicycle Production Rolls Forward

Gary Gardner

Production of bicycles topped 100 million units in 2000, the last year for which global data can be estimated[1] (See Figure 1) The nearly 9-percent increase over 1999, while robust, returns global production only to the levels of the early 1990s[2] Globally, the industry continues to struggle and to become more concentrated

Nearly all of the increase in 2000 came from China, where production reached 52 million units, up from 43 million in 1999[3] For the first time, China accounts for more than half of global output[4] (See Figure 2) The other major Asian players—India, Taiwan, and Japan—saw production stagnate or decline[5] Meanwhile, the European Union, the other major production center, saw output increase by a modest 3 6 percent[6]

Production in the United States, once a significant source of bicycles, has slipped steadily from 8 5 million units in 1995 to 1 1 million in 2000[7] But the country strengthened its place as the world's largest market in 2001, with purchases totaling more than 20 million units—one fifth of global production, and 15 percent more than in 2000[8] The United States now imports more than 95 percent of the bicycles it uses[9]

nk p 152

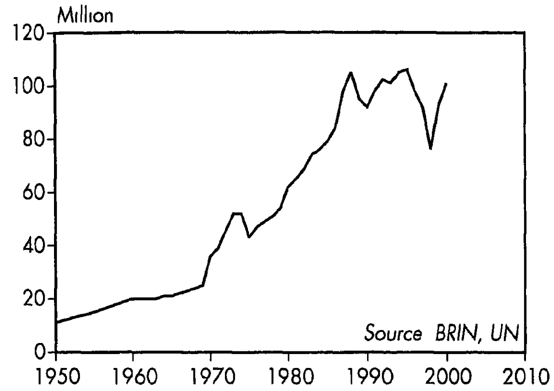
Indeed, a map of global bicycle flows would reveal bulging arrows from China to the rest of the world, especially the United States, and increasingly anemic arrows emanating from many other producers Of the roughly 46 countries with bicycle production data for 1995, more than a third have seen steady declines in production since then, even as global production recovered[10] Production increases have been most notable in low-wage nations such as China, Mexico, and Viet Nam[11]

Bicycle use is influenced by government policy and changes in technology, among other factors Municipal leadership in construction and promotion of a 300-kilometer-long network of bicycle paths in Bogota, Colombia, for example, is credited with boosting the cycling share of the city's population from 0 5 percent in 1997 to more than 5 percent today—more than five times the levels found in many car-centric countries such as the United States[12] Santiago, Chile, is following suit as it undertakes a 30–40 kilometer pilot project with funding from the Global Environment Facility[13] As a way to combat the city's notorious air pollution, the project could grow over 10 years into a 1,000-kilometer network if city plans are fully implemented[14]

Such investments can help reduce the dangers of cycling, a major impediment to bicycle use In surveys in three U S cities in the early 1990s, more than half of respondents cited lack of safety as an influential factor in their decisions not to cycle[15] Indeed cycling fatalities per kilometer traveled in the United States are 11 times higher than fatalities from driving[16] By contrast, cycling deaths in the Netherlands and Germany, where cycling-oriented laws and infrastructure are widespread, are about a quarter the level found in the United States[17]

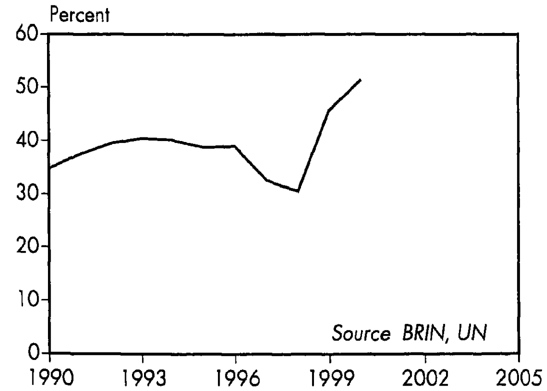
Emerging technologies could also affect cycling trends Sales of electric bicycles have grown rapidly since their debut in the early 1990s, jumping by 27 percent in 2001 alone[18] (See Figure 3) Though this is less than 1 percent of global bicycle production, growth could continue to be brisk as batteries become lighter and more powerful and as the advantages of electrics become better known By helping riders to go farther and cover hillier terrain than many would on a conventional bicycle, electrics have the potential to broaden interest in cycling One industry consultant says it is "entirely possible" that the majority of bikes sold 10 years from now will have an electric drive of some sort[19]

In summer 2000, a firm called Manhattan Scientifics unveiled an electric bicycle powered by a fuel cell rather than a battery[20] If successful, it could eliminate the technology's major environmental and performance blemish dependence on toxic batteries that have short operational lives This bike runs on hydrogen, the most abundant element in the universe, and a fuel whose only byproduct is water vapor It is also due to weigh less and run longer before refueling than today's battery-powered electrics[21] The company expects to have the new bike on the market in 2003[22]



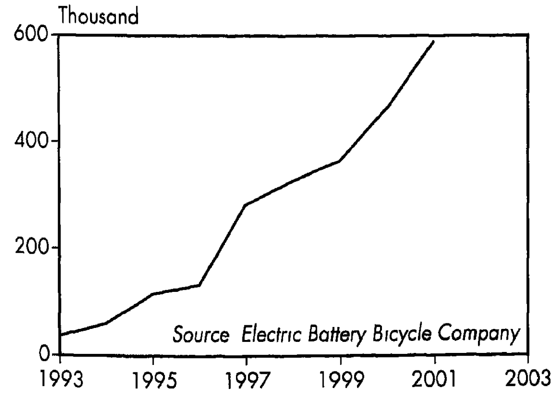
Source BRIN, UN

Figure 1 World Bicycle Production, 1950–2000



Source BRIN, UN

Figure 2 Chinese Bicycle Production as a Share of World Production, 1990–2000



Source Electric Battery Bicycle Company

Figure 3 World Electric Bicycle Sales, 1993–2001

World Bicycle Production, 1950–2000

Year	Production (million)
1950	11
1955	15
1960	20
1965	21
1970	36
1971	39
1972	46
1973	52
1974	52
1975	43
1976	47
1977	49
1978	51
1979	54
1980	62
1981	65
1982	69
1983	74
1984	76
1985	79
1986	84
1987	98
1988	105
1989	95
1990	92
1991	98
1992	102
1993	101
1994	105
1995	106
1996	98
1997	92
1998	76
1999	93
2000 (prel)	101

Sources Bicycle Retailer and Industry News, *Industry Directory 2002*, United Nations, *Industrial Commodity Statistics Yearbook, 1999*

Passenger Rail at Crossroads

Molly O Sheehan

Between 1988 and 1999, world rail travel stagnated at about 1 8 trillion passenger-kilometers[1] (See Figure 1) As the total volume of passenger travel grew, rail's share decreased in relation to road and air[2]

The global number masks huge national differences More than 1 million kilometers of tracks crisscross some 120 nations, but most train travel is in the former Soviet states, India, China, Western Europe, and Japan, which together account for more than 80 percent of all passenger-kilometers[3] (See Figure 2) Railroads in Western Europe and Japan are geared toward passenger service, whereas extensive rail networks in the United States and Canada are used primarily for freight[4]

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The role of railroads in world transport is constantly evolving After the first train ran in England in 1825, rail grew so rapidly that by 1900 it accounted for close to 90 percent of all passenger traffic in Europe and the United States[5] Once cars and planes developed markets, however, trains lost passengers Today, rail is poised for a renaissance as demand for transportation rises, particularly in developing countries, and as industrial nations seek greener alternatives to clogged airports and roads

Planes make more sense for long distances, and cars, transit, and bicycles for shorter trips But over 50–1,000 kilometers (30–600 miles), trains with enough passengers can be cheaper, more comfortable, and less polluting, given the high costs of flying large jets short distances and the high per capita fuel use and space required for automobiles[6]

High-speed rail has begun to fill this niche in Japan and Western Europe[7] Initially funded in part by World Bank loans, Japan's *shinkansen*, or "bullet train," opened in 1964 and linked Tokyo and Osaka[8] It has since been expanded and upgraded When France's fast train, the TGV, debuted in 1981, it cut the trip between Paris and Lyons from four to two hours, within a month, planes lost half their passengers on that route, and car traffic between those cities dropped by a third[9] Today, passengers on a United Airlines "flight" from Washington, DC , to Lyons connect at the Paris airport to the TGV for the final leg of their journey[10] Germany's ICE , introduced in 1991, prompted Lufthansa to stop flying between Hannover and Frankfurt[11] And in 2001, the new Thalys train led Air France to cancel its Paris-to-Brussels flights[12]

Many of the world's rail passengers live in developing Asia, where rail promises to efficiently connect dense urban centers China plans to boost its rail network and has lifted restrictions on foreign investors[13] Between 1997 and 2000, Chinese railways raised speeds three times and started scheduling more overnight trains[14] Future plans include a high-speed link between Shanghai and Beijing, a distance equal to the combined French and German high-speed tracks[15] Elsewhere, South Korea is building a high-speed rail link, and Taiwan is planning one as well[16]

While Japan's private rail network and France's public one both excel, many nations are struggling to find the best formula for them[17] In the United States, the government subsidized Amtrak to provide national rail service in 1971, but the company has yet to develop the quality of service needed to boost revenues sufficiently[18] After the United Kingdom divided and sold its state-run network in 1994, serious accidents showed that the new owner, Railtrack, was not maintaining the tracks well, repairs caused huge delays, prompting passengers to flee[19] The debacle has made officials in countries such as Germany slow their privatization plans[20] World Bank Railways Adviser Lou Thompson concludes that rail systems would work best if they were publicly defined and supported, but privately operated[21]

Whether private or public, operators must improve service to achieve rail's people-moving potential Train travel could be made quicker, for instance, if there were global standards for railway equipment that would ease trans-border travel, as well as advances in technology[22]

Passenger Rail at Crossroads

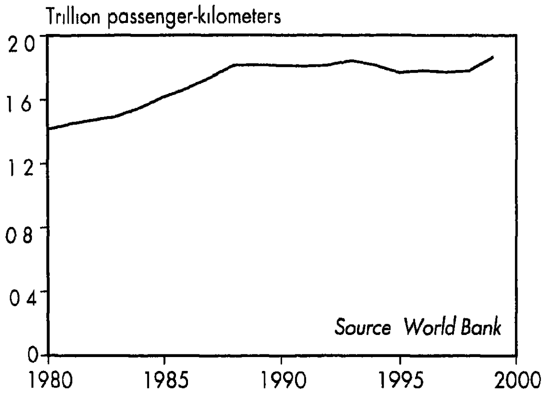
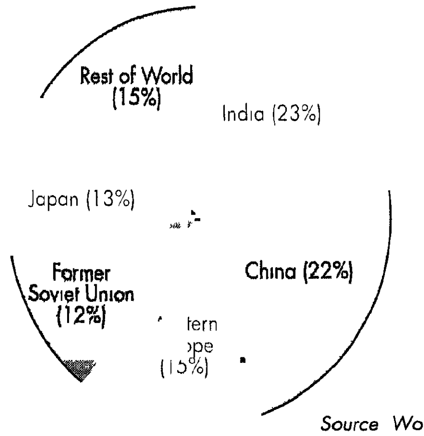


Figure 1 World Passenger Rail Travel, 1980–99



Source World Bank

Figure 2 World's Passenger Rail Ridership, by Region or Country, 1999

World Passenger Rail Travel, 1980–99

Year	Passenger-kilometers (trillion)
1980	1 4
1981	1 4
1982	1 5
1983	1 5
1984	1 5
1985	1 6
1986	1 7
1987	1 7
1988	1 8
1989	1 8
1990	1 8
1991	1 8
1992	1 8
1993	1 8
1994	1 8
1995	1 8
1996	1 8
1997	1 8
1998	1 8
1999	1 9

Source World Bank, "Railways Database", Louis Thompson, Railways Advisor, World Bank

Communications Trends

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Internet Continues Meteoric Rise

Mobile Phone Use Booms

Internet Continues Meteoric Rise

Payal Sampat

In 2001, about 520 million people used the Internet, linked by a global network of 147 million host computers [1] (See Figure 1) The Internet has almost doubled in size since 1999, although since 1996 it has been growing more slowly than it did initially[2] Today, 1 in every 12 people in the world goes online to get news, send e-mail, buy goods, or be entertained [3]

The United States, where the Internet was developed, continues to dominate this electronic network About a third of all people online are American—some 166 million [4] (See Figure 2) In the last two years, Japan's Internet users have doubled in size to 47 million [5] And in China, almost 34 million people used the Internet in 2001, nearly four times more than in 1999 [6] Today, six times more Chinese use the Internet than own cars [7] South Korea has expanded its online numbers just as rapidly, going from just 6 million in 1999 to 22 million two years later[8]

Link p 112

In nine wired nations, more than half the population uses the Internet [9] (See Figure 3) Sweden leads this category, with 63 percent online, Iceland, Denmark, and the Netherlands are also on this list [10] Most people in Hong Kong, Singapore, and Taiwan go online regularly [11] In the more populated Asian countries, however, just a small share of people have access to the Internet 2 6 percent of China, 1 percent of Indonesia, and less than 0 5 percent of India, for example [12] More people in Singapore use the Internet than in all of Indonesia—a country with 50 times as many people [13]

One in five Internet users lives in the developing world—about 100 million people [14] Of the 25 million online in Latin America, nearly half live in Brazil [15] An additional 4 million are in Argentina, and 3 4 million in Mexico [16] But most of Africa is left out of this global network, still beleaguered by the lack of infrastructure, particularly telephone lines, and high connection costs Even today, just 4 million Africans have Internet access—2 4 million in South Africa, and another 600,000 in Egypt—just a little more han the online population of Hong Kong [17]

English is still the primary language used nline, but for the first time ever, in 2001 the majority of people (292 million) using the Internet were non-English speakers [18] Nearly 32 percent of them use European languages, led by German and Spanish, while 25 percent use Asian languages such as Japanese, Chinese, and Korean [19] Forecasters estimate that by 2007 Chinese will be the most widely used language on the Internet [20]

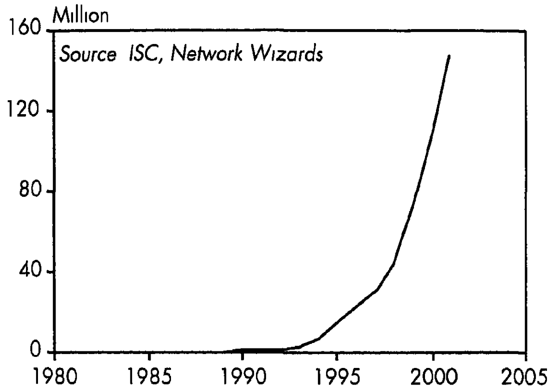
The value of many Internet stocks took a tumble in 2001, dampening the growth of online commercial activity Globally, e-commerce reached $600 billion in 2001—which is 68 percent more than spent in 2000 but well below levels forecast before the economic downslide [21] About 40 percent of this total was spent in the United States, and another 10 percent in Japan [22] In the United States, $4 billion was spent on advertising online in 2001, accounting for some 4 percent of the nation's advertising budget [23]

At 100 trillion bytes, the World Wide Web stores five times more data than the U S Library of Congress—although the quality of information is often dubious [24] At last count, there were 10 billion pages on the Web, an 11-fold expansion since 1998 [25]

Although the Internet is making only slow inroads in some of the poorest parts of the world, it can be extremely useful when it does get there Telemedicine projects in Mozambique, Uganda, and Bangladesh have improved medical care in remote and poorly equipped areas Using low-cost equipment, rural doctors can send X-rays or laboratory results to medical experts at hospitals in larger cities, and get advice about treatment [26] At 20 learning centers in India and in Morocco, primary school teachers are getting long-distance training over single terminal hookups [27]

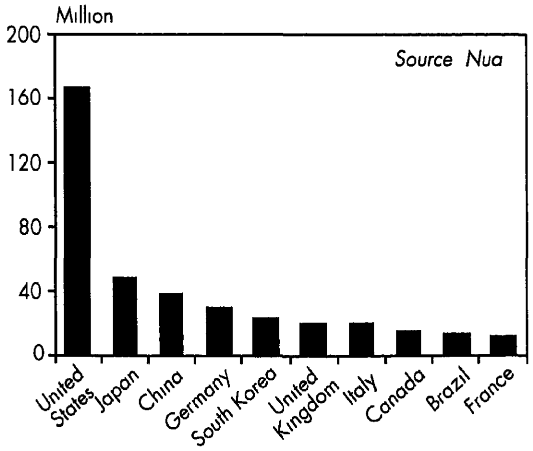
Unfortunately, the wired world is generating piles of hazardous electronic wastes a computer monitor, for instance, contains four to eight pounds of lead [28] Some 50–80 percent of used computers, circuit boards, and monitors discarded in the United States are sent to China, India, and Pakistan for recycling and disposal, exposing workers to toxins and poisoning groundwater supplies [29]

Internet Continues Meteoric Rise



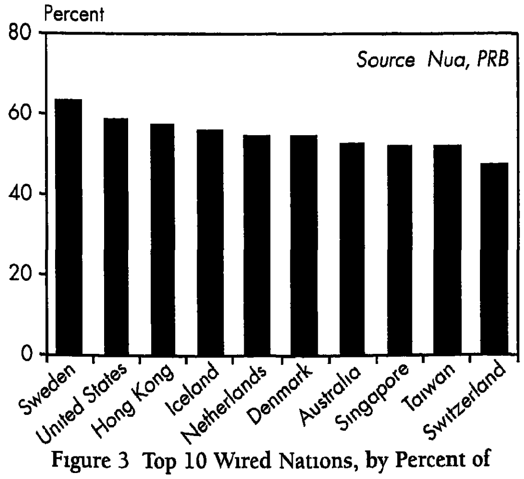
Source ISC, Network Wizards

Figure 1 Internet Host Computers, 1981–2001



Source Nua

Figure 2 Top 10 Wired Nations, by Number of Internet Users, 2001



Source Nua, PRB

Figure 3 Top 10 Wired Nations, by Percent of Population Online, 2001

Internet Host Computers, 1981–2001

Year	Host Computers (number)
1981	213
1982	235
1983	562
1984	1,024
1985	2,308
1986	5,089
1987	28,174
1988	80,000
1989	159,000
1990	376,000
1991	727,000
1992	1,313,000
1993	2,217,000
1994	5,846,000
1995	14,352,000
1996	21,819,000
1997	29,670,000
1998	43,230,000
1999	72,398,092
2000	109,574,429
2001	147,344,723

Source Internet Software Consortium and Network Wizards

Mobile Phone Use Booms

Molly O. Sheehan

The number of cellular or mobile telephone subscribers rose 38 percent to nearly 1 billion in 2001, according to the International Telecommunication Union (ITU), a specialized U.N. agency charged with fostering common global telecom policies.[1] (See Figure 1.) Mobile subscribers worldwide doubled every 20 months during the 1990s.[2]

While most mobile phones are owned by people with access to conventional, fixed-line phone service, for a growing number of people in the developing world they are the sole communications tool.[3] As a result, the cellular phone boom is swelling the total number of people with access to phone service. It took 100 years to connect the first billion people by phone, but only 10 years for the second billion.[4] The ITU forecasts that at some point in 2002, the number of cellular subscribers will surpass the number of fixed-line connections, which stood at 1.045 billion in 2001.[5] (See Figure 2.)

Links pp. 110, 112

Some 40 percent of the world's mobile phone users are in Europe, and 34 percent are in Asia.[6] The largest manufacturer of mobile phones, Nokia, is based in Finland, where cell phones dominate the economy.[7] As some markets in Western Europe reached saturation in 2001 (see Figure 3), a slowdown in demand caused global shipments of cell phones to decline.[8]

There is still considerable room for growth, however, in the world's largest markets. The United States, with more than 109 million cellular subscribers, had more mobile phones in use than any other nation in 2000 but less than 40 mobiles per 100 people.[9] Contracts that charge subscribers for incoming as well as outgoing calls may have dampened growth.[10]

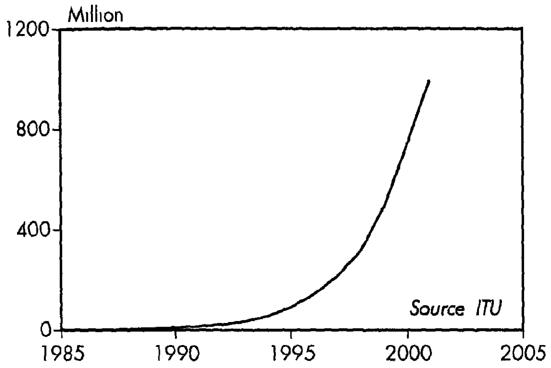
China was the second largest market in 2000, with 85 million subscribers, but less than 7 mobile phones for every 100 people.[11] The number of mobile subscribers in China grew on average 85 percent a year between 1996 and 1999. China Mobile has more subscribers than any other cellular phone company in the world.[12]

In general, the greatest growth is occurring in developing countries, where prepaid phone cards have become popular for use with mobiles. These reduce the risk to the phone companies and allow people to use cellulars who do not have sufficient credit to qualify for conventional phone service.[13] In Latin America, where prepaid services prevail, the number of new mobile users has exceeded new subscribers to fixed-line services each year since 1997; one in four phone users in the region now relies on a cellular.[14]

In Africa, the number of mobile phones surpassed the number of fixed-line connections in 2001.[15] Four out of five subscribers use prepaid cards.[16] Between 1995 and 2001, the number of mobile networks in Africa grew from 33 to 100, as the number of countries without a mobile network shrunk from 28 to just 6.[17] Although in 1998 only Finland and Cambodia had more mobile subscribers than fixed lines, by the end of 2000 some 38 countries were in this category—and 20 were in Africa.[18]

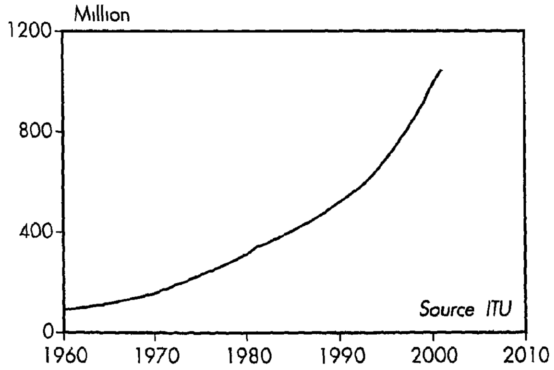
Technologies and policies that promote cell phone use can benefit poor people. In 2001, a company developed a wind-up mobile phone charger that is well suited to rural areas of the developing world that lack reliable power.[19] Muhammad Yunus, the founder of the Grameen Bank in Bangladesh, believes that loans for small communications businesses can empower people.[20] Since 1997, Grameen Telecom has sold some 2,200 mobile phones to rural entrepreneurs in Bangladesh, mainly women, who in turn sell phone services to their neighbors.[21]

There are drawbacks, however, to increased reliance on mobile phones. For instance, using them while driving poses a hazard on the roads.[22] Discarded cell phones are a growing contributor to electronic waste, as consumers seek the latest technology and some manufacturers introduce disposable models.[23] Finally, researchers continue to ask whether the radio waves emitted by cell phones harm humans, particularly children whose thinner skulls and developing nervous systems make them more vulnerable.[24] In January 2002, the United Kingdom announced several research projects coordinated by the World Health Organization to further investigate this issue.[25]



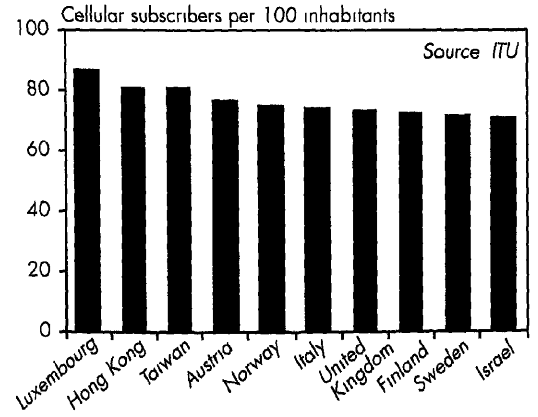
Source ITU

Figure 1 Cellular Telephone Subscribers Worldwide, 1985–2001



Source ITU

Figure 2 Telephone Lines Worldwide, 1960–2001



Source ITU

Figure 3 Top 10 Countries with Cellular Phones Per Person, 2000

Telephone Lines and Cellular Phone Subscribers Worldwide, 1960–2001

Year	Telephone Lines	Cellular Phone Subscribers
	(million)	
1960	89	-
1965	115	-
1970	156	-
1975	229	-
1976	244	-
1977	259	-
1978	276	-
1979	294	-
1980	311	-
1981	339	-
1982	354	-
1983	370	-
1984	388	-
1985	407	1
1986	426	1
1987	446	2
1988	469	4
1989	493	7
1990	519	11
1991	545	16
1992	573	23
1993	606	34
1994	646	56
1995	692	91
1996	741	144
1997	781	215
1998	849	319
1999	907	491
2000	986	741
2001 (prel)	1,045	995

Source ITU, press release, 8 February 2002, ITU, "Cellular Subscribers," 9 January 2002, ITU, *STARS* database

Health and Social Trends

HARVEY NELSON M/MC PHOTOSHARE WWW.JHUCCP.ORG/MMC

Population Growing Steadily

AIDS Passes 20-Year Mark

Population Growing Steadily

Danielle Nierenberg

The world's population swelled to 6 2 billion in 2001—more than double the number in 1950[1] (See Figure 1) This represents an increase of 77 million people over the preceding year, roughly the equivalent of another Germany[2] (See Figure 2)

More than 95 percent of this growth is occurring in the developing world And most of the people are added in just a handful of countries—India and China alone account for over one third of the growth[3]

Africa has the highest growth rate of any region, increasing by 2 4 percent each year[4] Population there is expected to more than double—from 800 million to 2 3 billion—by 2050[5] Growth rates in Asia are lower, but they apply to a much larger base[6] More than half of the world's people—3 7 billion—live in Asia[7] In South Central Asia, which includes India, Pakistan, Bangladesh, and Afghanistan, population is projected to double from the current 1 5 billion by mid-century[8]

Link p 148

While population in developing nations continues to rise, many industrial nations have low fertility rates In Armenia, Italy, Spain, the Ukraine, and Russia—where the average woman bears 1 2 children in her lifetime—the low number of births has sparked concern about how these nations will adjust to aging populations and a smaller work force[9]

The global rate of population growth has actually decreased over the past three decades—from 2 1 percent a year in 1970 to under 1 3 percent today[10] (See Figure 3) But this does not mean that population growth is on the decline In fact, the number of people added to the planet each year is near the all-time high reached in the late 1980s[11]

In the regions of the world where population continues to grow, the increase is largely caused by a combination of poverty, discrimination and violence against women, and unmet needs for reproductive health care The United Nations reports that the annual population growth rate in "more developed" nations is just 0 3 percent, compared with 1 62 percent in "less developed" nations[12] And the "least developed" nations, predominantly in Africa, are growing at 2 5 percent each year[13]

Rapid population growth makes it hard to increase living standards Many cities in the developing world have doubled their populations in just the past 15 years, straining their capacity to provide schooling, heath care, and jobs to growing generations[14]

Although contraceptive use has grown sixfold over the past 40 years—from just 10 percent of couples in 1960 to 60 percent in 2000—there are still barriers preventing women from planning pregnancies[15] In some sub-Saharan African nations, birth control costs 20 percent of the average income[16] And sexual violence often leads to unwanted pregnancy—one study in Nicaragua found that abused women are twice as likely as other women to have four or more children[17]

An estimated 125 million women do not want to be pregnant but are not using any type of contraception[18] Overall, 350 million women lack any access to family planning services[19] In addition, the "global gag rule"—the U S administrations block on aid to international agencies that advocate or counsel patients about abortion—and a shortage of contraceptives worldwide limit the choices women and couples can make about family size[20]

This unmet need is likely to grow, exacerbated by growth in the number of young people worldwide and a growing desire to delay childbearing The largest generation of young people in human history—1 7 billion people aged 10–24—is now reaching reproductive age[21] Today, 525 million women use contraception, a number projected to reach 742 million by 2015[22]

But halting population growth is not just about controlling births Gender inequity in education, politics, and employment prevents women from controlling their own fertility Only 52 percent of girls in "least developed" nations stay in school after grade 4, and most of the world's illiterates are women[23] Women are still vastly outnumbered by men at all levels of government[24]

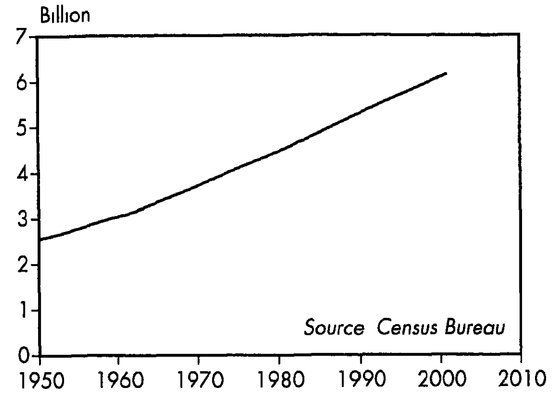


Figure 1 World Population, 1950–2001

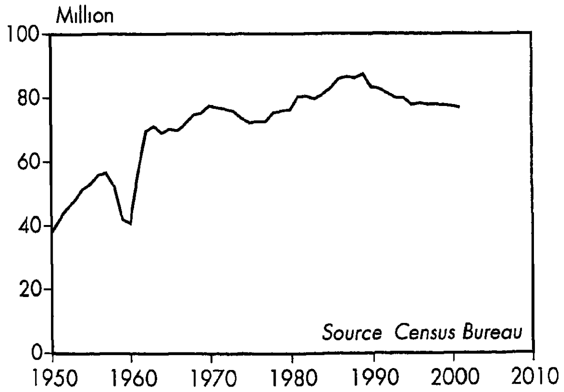


Figure 2 Annual Addition to World Population, 1950–2001

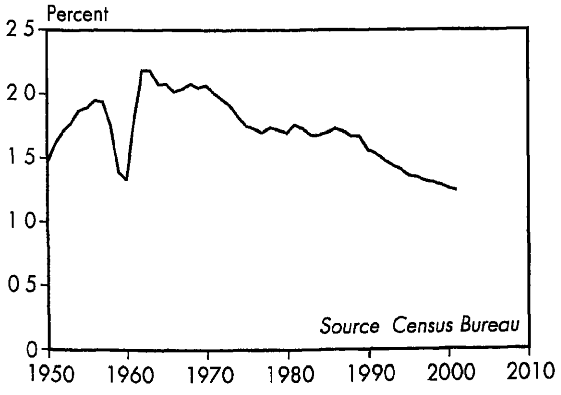


Figure 3 Annual Growth Rate of World Population, 1950–2001

World Population, Total and Annual Addition, 1950–2001

Year	Total*	Annual Addition
	(billion)	(million)
1950	2 555	38
1955	2 780	53
1960	3 039	41
1965	3 346	70
1970	3 708	78
1971	3 785	77
1972	3 862	77
1973	3 939	76
1974	4 015	74
1975	4 088	72
1976	4 160	73
1977	4 233	72
1978	4 305	75
1979	4 381	76
1980	4 457	76
1981	4 533	80
1982	4 613	81
1983	4 694	80
1984	4 774	81
1985	4 855	83
1986	4 938	86
1987	5 024	87
1988	5 110	86
1989	5 196	87
1990	5 284	83
1991	5 367	83
1992	5 450	81
1993	5 531	80
1994	5 611	80
1995	5 691	78
1996	5 769	78
1997	5,847	78
1998	5 925	78
1999	6 003	78
2000	6 080	77
2001 (prel)	6 157	77

*Total at mid-year

Source U S Bureau of the Census, *International Data Base*, electronic database, Suitland, MD, updated 10 May 2000

AIDS Passes 20-Year Mark

Ann Hwang

Twenty years after it was recognized as a new disease, AIDS has claimed the lives of almost 25 million people—nearly equivalent to the population of Venezuela[1] About 40 million more are living with HIV, the virus that causes AIDS In 2001 alone, 5 million people became infected with the virus and 3 million died[2] (See Figures 1 and 2)

Sub-Saharan Africa remains the epidemic's epicenter one tenth of the world lives there, but they account for nearly three quarters of the world's HIV infections[3] AIDS is now that continent's leading cause of death[4] Double-digit infection rates in many southern African countries have lowered life expectancy by 15 years, and in four countries—Botswana, Malawi, Mozambique, and Swaziland—people on average can now expect to die before they turn 40[5] AIDS is claiming the lives of the continent's teachers, doctors, farmers, workers, and parents As it does, it not only erases decades of social and economic progress but jeopardizes future growth Some countries could lose more than 20 percent of their gross domestic product by 2020 due to the effect of AIDS on their work force and productivity[6]

While infection rates elsewhere have not reached the catastrophic levels found in sub-Saharan Africa, the pace of the pandemic's spread is alarming In Eastern Europe and Central Asia, the number of infections jumped 33 percent in 2001—from 750,000 to 1 million—fueled largely by the use of injection drugs[7]

Asia—home to half the world—could become another disease epicenter In a number of Indian states, more than 3 percent of the population is infected, a level that could spark an explosive disease spread[8] Similar hot spots are found in China, where HIV is spreading through injection drug use, sexual contact, and, at least in the central provinces, unsanitary blood-selling practices Some villages where blood-selling was common now have infection rates above 25 percent[9]

In industrial and developing countries alike, discrimination compounds the suffering of people living with HIV/AIDS Infected individuals have been fired from their jobs, disowned by their families, and even forcibly sterilized A survey of 121 countries found that only 21 nations—representing 16 percent of the world's population—have specific laws to protect HIV-positive individuals from discrimination[10]

In 1984, U S Health and Human Services Secretary Margaret Heckler predicted, "There will be a vaccine in a very few years and a cure for AIDS before 1990"[11] Though anti-retroviral therapy has prolonged the lives of many of those infected with HIV, there is still no cure The therapies themselves have dangerous side effects, such as nerve damage and heart disease And as HIV mutates, it can evade the drugs' effects and become resistant to treatment Researchers from the Rand Corporation and the University of California at San Diego recently estimated that half of the HIV patients in the United States have a virus that is resistant to at least one anti-retroviral drug[12]

In developing countries where 95 percent of HIV-infected people live, anti-retroviral drugs are nearly impossible to obtain[13] In sub-Saharan Africa, for example, only 30,000 people—one tenth of 1 percent of those infected—receive the triple anti-retroviral therapy recommended to combat HIV[14] Despite opposition from pharmaceutical companies, some companies and countries are manufacturing generic versions of anti-retroviral drugs at a fraction of the price of the patented versions South Africa's Treatment Action Campaign successfully sued the government to increase access to nevirapine, a drug that prevents the transmission of HIV from mother to child[15]

But even deeply discounted drugs will likely be beyond the reach of most developing countries And help from the industrial world may be slow in arriving In April 2001, U N Secretary-General Kofi Annan announced the creation of a global fund to combat AIDS, tuberculosis, and malaria The fund aimed to raise $7–10 billion, but by year's end had received only $2 billion in pledges[16] And after September 11th, the U S Congress slashed its contribution to the new fund from nearly $1 billion to only $200 million—less than a dollar per American[17]

AIDS Passes 20-Year Mark

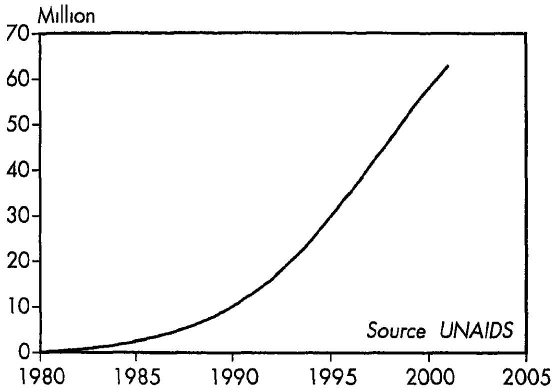


Figure 1 Estimates of Cumulative HIV Infections Worldwide, 1980–2001

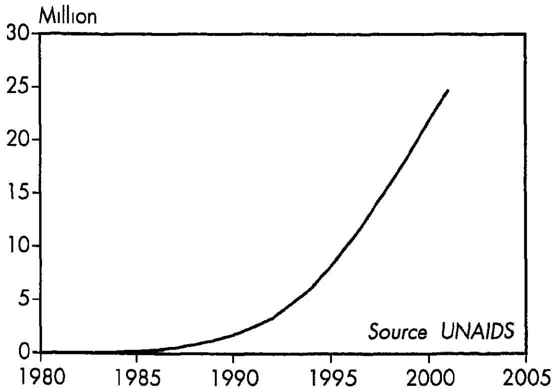


Figure 2 Estimates of Cumulative AIDS Deaths Worldwide, 1980–2001

Cumulative HIV Infections and AIDS Deaths Worldwide, 1980–2001

Year	HIV Infections	AIDS Deaths
	(million)	
1980	0 1	0 0
1981	0 3	0 0
1982	0 7	0 0
1983	1 2	0 0
1984	1 7	0 1
1985	2 4	0 2
1986	3 4	0 3
1987	4 5	0 5
1988	5 9	0 8
1989	7 8	1 2
1990	10 0	1 7
1991	12 8	2 4
1992	16 1	3 3
1993	20 1	4 7
1994	24 5	6 2
1995	29 8	8 2
1996	35 3	10 6
1997	40 9	13 2
1998	46 6	15 9
1999	52 6	18 8
2000	57 9	21 8
2001 (prel)	62 9	24 8

Sources UNAIDS, *AIDS Epidemic Update December 2000* and *2001*, Neff Walker, UNAIDS, 20 March 2000

Military Trends

Number of Violent Conflicts Declines

Peacekeeping Expenditures Rise Again

Number of Violent Conflicts Declines

Michael Renner

The number of wars worldwide stood at 31 in 2001, down from 35 the previous year, according to AKUF, a conflict research group at the University of Hamburg.[1] (See Figure 1.) In addition, there were 15 "armed conflicts" active in 2001 that were not of sufficient severity to meet AKUF's criteria for war. Combining these two categories, the total number of violent clashes declined slightly—from 47 in 2000 to 46.[2]

The war between Ethiopia and Eritrea ended, and violence in Laos, Chiapas (Mexico), and Nigeria's oil-rich Niger delta subsided.[3] But three conflicts began during 2001: the war against the Taliban regime and the Al Qaeda network in Afghanistan, separatist violence by Albanians in Macedonia, and fighting between Christian and Muslim militias in Nigeria.[4]

Links **pp 68, 96, 162**

The significant decline in the number of conflicts during the 1990s is matched by a decline in the "magnitude" of violence. (The Center for International Development and Conflict Management (CIDCM) at the University of Maryland rates each conflict according to the number of deaths, dislocations, and physical damage wrought.)[5] Likewise, the proportion of countries involved in violent confrontations declined. In 1999, 18 percent of all states were at war, down from 33 percent in 1991.[6]

The September 11th terrorist attacks and the war in Afghanistan overshadowed virtually all other conflicts, and "anti-terrorism" strongly tinted the portrayal and public perception of a number of struggles, including the Israeli-Palestinian confrontation, Russia's fight against Chechen rebels, and the Indian-Pakistani standoff over Kashmir.

Most of the current conflicts are taking place in sub-Saharan Africa, the Middle East, and portions of Asia.[7] And CIDCM finds that countries in these regions "are at serious risk of armed conflict and political instability for the foreseeable future"—mostly because they lack stable and democratic institutions, suffer from a lack of resources, and have limited capacity to address ethnic and other disputes.[8]

It is becoming harder and harder to define and categorize violent conflicts, and not only because information about battles, tactics, motivations, and victims is spotty or unreliable. Armed forces are splintering in many countries even as private or semi-private security forces of various stripes multiply. And violent conflict is often not driven by ideology or the quest for government power but by the motivation to plunder lucrative resources such as diamonds, minerals, oil, and timber. Altogether, about a quarter of the armed conflicts waged during 2000 had a strong resource dimension.[9]

Different definitions and empirical methods among peace research groups lead to somewhat different results, although there is agreement on the broad, overall trends.[10] (See Figure 2.) Of 111 conflicts recorded by the researchers at the Uppsala Conflict Data Project during 1989–2000, 104 were internal (including 9 in which there was also foreign intervention).[11] Only 7 conflicts were interstate wars.[12]

Conflict researchers at the Heidelberg Institute for International Conflict Research in Germany (known as HIIK) cast a wider net than AKUF and the Uppsala group in their assessments of worldwide conflicts. HIIK reports that the number of political conflicts in the world has climbed fairly steadily from 108 in 1992 to 155 in 2001.[13] On the positive side, just 38 of the 155 conflicts were carried out by violent means.[14] (See Figure 3.) And HIIK finds that in more than one third of the conflicts active in 2001, negotiations and other means helped dampen the disputes.[15]

The overall conflict trends since 1990 are encouraging. But taken as a whole, the past century was extraordinarily violent. Milton Leitenberg of the University of Maryland estimates that from 1945 to 2000, some 50–51 million people were killed in wars and other violent conflicts.[16] For the entire twentieth century, he estimates 130–142 million war-related deaths, and a chilling 214–226 million if government killings in non-war situations are included.[17]

Number of Violent Conflicts Declines

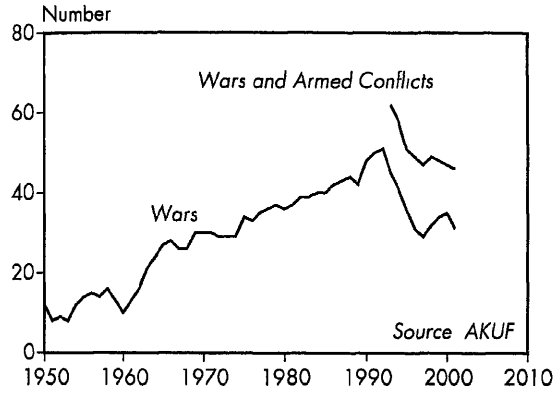


Figure 1 Wars and Armed Conflicts, 1950–2001

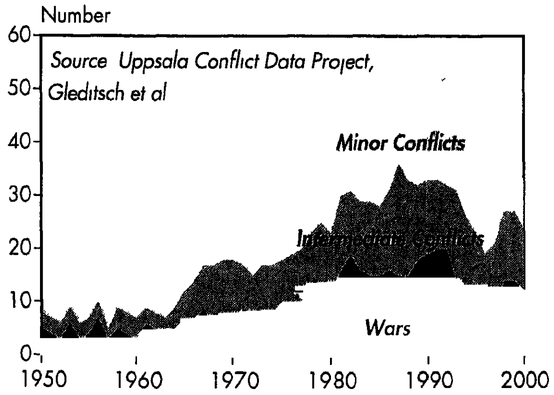


Figure 2 Wars and Intermediate and Minor Conflicts, 1950–2000

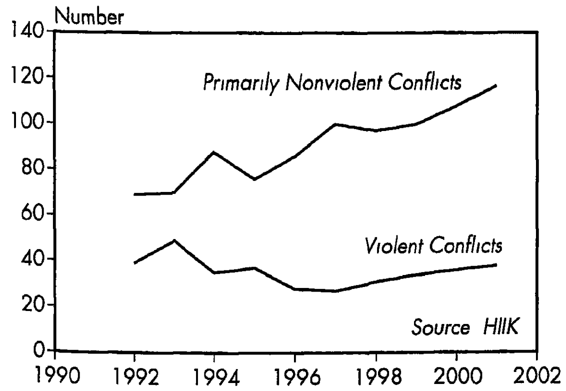


Figure 3 Violent and Nonviolent Conflicts, 1992–2001

Wars and Armed Conflicts, 1950–2001

Year	Wars	Wars and Armed Conflicts
	(number)	
1950	12	
1955	14	
1960	10	
1965	27	
1970	30	
1971	30	
1972	29	
1973	29	
1974	29	
1975	34	
1976	33	
1977	35	
1978	36	
1979	37	
1980	36	
1981	37	
1982	39	
1983	39	
1984	40	
1985	40	
1986	42	
1987	43	
1988	44	
1989	42	
1990	48	
1991	50	
1992	51	
1993	45	62
1994	41	58
1995	36	51
1996	31	49
1997	29	47
1998	32	49
1999	34	48
2000	35	47
2001(prel)	31	46

Source Arbeitsgemeinschaft Kriegsursachenforschung, Institute for Political Science, University of Hamburg

Peacekeeping Expenditures Rise Again

Michael Renner

Expenditures for United Nations peacekeeping operations are expected to continue their rapid upswing, growing from $2 6 billion for the July 2000–June 2001 period to an estimated $2 7–3 billion for July 2001 to June 2002 [1] (See Figure 1) This means that peacekeeping spending is now edging toward the peak budgets of the mid-1990s

More than 47,000 soldiers, military observers, and civilian police served in 15 peacekeeping missions active at the end of 2001, up 24 percent from about 38,000 a year earlier [2] (See Figure 2) The missions were supported by 12,126 local and international civilian personnel [3] (In addition to peacekeeping and observer operations, the United Nations also maintained 13 small political and peace-building missions involving about 600 mostly civilian staff, one of these has been working in Afghanistan since 1993)[4] Since the inception of peacekeeping operations in 1948, a total of 1,706 peacekeepers have died in the line of duty[5]

Link p 94

Ninety countries contributed personnel to the U N missions during 2001 [6] Bangladesh and Pakistan scaled up their involvement dramatically, these two countries together currently account for about one fifth of all deployed peacekeepers [7] Nigeria, India, Jordan, Ghana, Kenya, and Australia are also major contributors Rounded out by Ukraine and Portugal, the leading 10 sources of personnel provided 58 percent of the total [8] The five permanent members of the Security Council, by comparison, kept their involvement limited to about 6 percent [9]

No new missions were initiated or authorized during 2001 On 27 March and 15 December 2001, the United States vetoed resolutions before the U N Security Council to establish a U N observer force to protect Palestinian civilians in the West Bank and Gaza Strip and to send monitors to help prevent further Israeli-Palestinian violence [10] The vetoes followed similar votes in December 2000 [11]

U N peacekeeping activities and expenditures continued to be dominated by just three operations [12] About 17,000 peacekeepers—more than a third of the total—are stationed in Sierra Leone alone, where the United Nations is trying to end a decade-long conflict revolving around lucrative diamond resources [13] Some 8,500 peacekeepers are in East Timor, and about 4,500 in Kosovo [14] But sizable deployments are also found in southern Lebanon, at the border separating Ethiopia and Eritrea, and in the Democratic Republic of Congo [15]

Other missions continue at the India-Pakistan border (since 1949), in Cyprus (1964), on the Golan Heights separating Israel and Syria (1974), at the Iraq-Kuwait border (1991), in Western Sahara (1991), in Georgia (1993), in Bosnia (1995), and on the Prevlaka peninsula between Croatia and Serbia (1996) [16]

As of the end of October 2001, U N members owed the organization $1 9 billion for peacekeeping operations [17] (See Figure 3) The United States accounts for 41 percent of the total unpaid dues, or $787 million [18] Following payment of some long-standing arrears, this is a significantly lower share than in recent years [19] With these payments, the United Nations hopes that "for the first time in many years [it] might have a secure basis with which to do business "[20]

In addition to U N peacekeeping operations, some three dozen additional missions are being carried out by regional or military organizations, such as NATO, the Organization for Security and Co-operation in Europe, and the Economic Community of West African States, or by ad hoc coalitions of states Many of them are very small By far the largest are NATO-led operations in Bosnia, Kosovo, and Macedonia Together, these Balkan missions deploy about 60,000 soldiers and cost an estimated $8–9 billion annually[21]

In December 2001, the U N Security Council endorsed creation of a British-led International Security Assistance Force to ensure security in Kabul, Afghanistan's capital, following ouster of the Taliban [22] A force of up to 5,000 soldiers was authorized for a six-month period

Peacekeeping Expenditures Rise Again

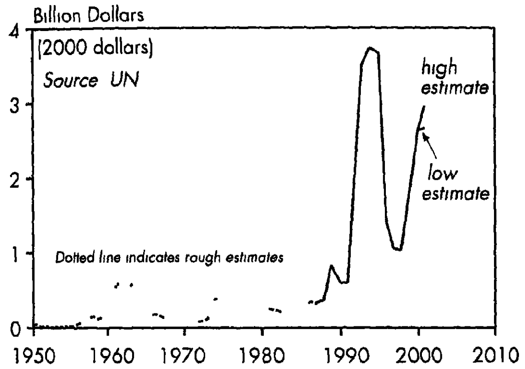


Figure 1. U.N. Peacekeeping Expenditures, 1950–2001

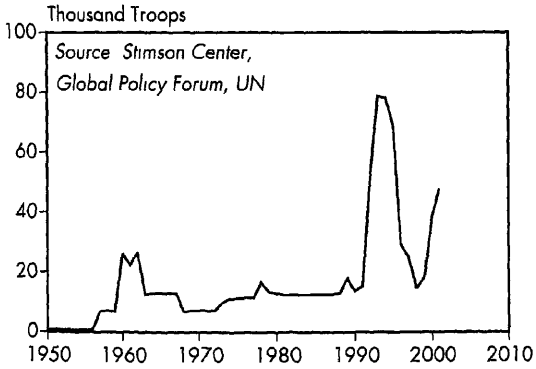


Figure 2. U.N. Peacekeeping Personnel, 1950–2001

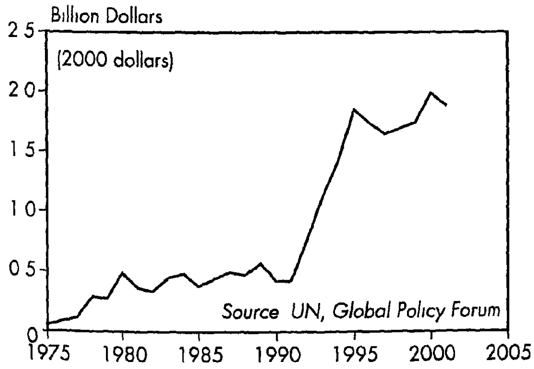


Figure 3. Arrears of U.N. Members for Peacekeeping Expenses, 1975–2001

U.N. Peacekeeping Expenditures, 1986–2001

Year	Expenditure (bill. 2000 dollars)
1986	0.344
1987	0.331
1988	0.355
1989	0.815
1990	0.573
1991	0.585
1992	2.058
1993	3.480
1994	3.724
1995	3.668
1996*	1.423
1997*	1.039
1998*	1.037
1999*	1.683
2000*	2.630
2001* (low)	2.650
(high)	2.950

* July to June of following year

Sources: U.N. Department of Peacekeeping Operations; U.N. Department of Public Information

PART TWO
Special Features

Environment Features

Farmland Quality Deteriorating
Forest Loss Unchecked
Freshwater Species at Increasing Risk
Transboundary Parks Become Popular
Semiconductors Have Hidden Costs
Toxic Waste Largely Unseen
Rio Treaties Post Some Success

Farmland Quality Deteriorating

Brian Halweil

A substantial area of the world's farmland is degraded and getting more so, particularly in the developing world[1] A recent analysis found that 10–20 percent of the world's 1 5 billion hectares of cropland—150–300 million hectares—suffers from some level of degradation[2] Moderate, severe, or extreme degradation affects 7–14 percent, or 105–210 million hectares[3] These estimates come from a reanalysis of data collected for the 1991 *Global Assessment of the Status of Human-Induced Soil Degradation* (GLASOD)[4]

Another recent survey of land degradation studies found that roughly one quarter of the farmland in the developing world suffers from degradation, and the pace of decline has accelerated in the past 50 years[5] Compared with the industrial world's soils, the tropical soils of the developing world are older (they were not rejuvenated by the last glaciation), exposed to more severe weather, more often in hilly or mountainous areas, and require more careful management to avoid degradation[6]

Links, pp 26, 30, 34, 152

Farmland in arid areas—both rangeland and cropland—is particularly susceptible to degradation, because the low rainfall and sparse vegetation mean that soils and plants recover more slowly[7] Over 70 percent of the world's rangelands—which cover 3 4 billion hectares worldwide and are found mostly in arid areas—suffers from moderate to very severe degradation as a result of overgrazing, changes in rainfall, and deforestation[8]

Among the most common causes of farmland degradation are excessive tillage and removal of vegetation (including crops and forests), which leaves the soil exposed to rain and wind Too many animals feeding on an area of land can also strip it of vegetation and expose it to erosion and other degradation GLASOD attributes about 35 percent of human-induced degradation around the world to overgrazing and about 28 percent to other forms of agricultural mismanagement[9] Inappropriate use of land not suited to agriculture, because it is too dry or steeply sloping, can also lead to degradation A survey of Central American cropland found that nearly half is used inappropriately—more than 30 percent of the region's land is used for grazing, while only 15 percent is actually suited for pasture[10]

While excessive use of fertilizers causes widespread damage to soils and waterways in wealthy nations, in the developing world farmland generally suffers from the depletion of nutrients as farmers continuously harvest crops without fertilizing or fallowing the land Farmers in Central Africa lose 30–60 kilograms of nutrients (primarily nitrogen, phosphorus, and potassium) per hectare each year, a figure that climbs to above 60 kilograms in East Africa[11] In Latin America and the Caribbean, the region's soils lose around 54 kilograms per hectare each year, with losses concentrated in Argentina and Brazil[12]

Degradation undercuts food production and farm income, as the land supports smaller harvests and costs more to maintain[13] (See Table 1) Each year, some 5–8 million hectares of farmland go out of production as a result of degradation[14] Worldwide, land degradation has reduced cumulative food production by an estimated 13 percent on cropland and 4 percent for pasture over the last half-century[15] A study of West Africa found that child mortality was highest in areas with the highest soil degradation[16]

Soil erosion is perhaps the most damaging form of farmland degradation, because it removes the foundation on which crops, wild plants, and other life subsist and because it takes hundreds of years for soils to rebuild GLASOD suggested that erosion by water (when rain removes soil from fields) is the dominant form of degradation on all continents, present on half the world's degraded lands[17] Wind erosion accounts for another 30 percent[18]

In the United States, one of the few nations where erosion rates have been tracked for several decades, the rate of erosion has declined substantially since 1982, from 2 65 tons per hectare in 1982 to 1 8 tons in 1997[19] Despite these improvements—largely attributed to greater adoption of reduced tillage practices and efforts to set aside highly erodible cropland—the nation still loses nearly 6 tons of soil for each ton of grain harvested[20]

Salinization is the most common form of degradation on irrigated cropland This buildup of salts, as excess irrigation water evaporates and concentrates toxic salts near the soil surface, can devastate yields, and often force the abandonment of irrigated land altogether An estimated 47 7 million hectares of land worldwide—some 20 percent of the world's total irrigated land—are damaged by salinization, costing farmers roughly $11 billion each year in reduced harvests [21]

Beyond the farm, degradation can damage water supplies, roads, and other infrastructure through soil erosion, runoff, flooding, and dam sedimentation [22] At the global level, farmland degradation releases carbon dioxide from soils into the atmosphere and can fuel dust clouds and sandstorms that blow across continents and even oceans [23] In extreme cases, soil degradation can prompt massive human movements, worldwide, desertification (land degradation in arid areas) could displace more than 135 million, and threatens the livelihoods of more than 1 billion people [24]

Farmers can help reverse land degradation by improving fertilization practices, planting tree crops, and using cover crops (crops added to the rotation to protect the soil), green manures (crops that protect the soil and add nutrients), and other techniques that help protect and build soil [25] Among the more promising trends is the rapid shift by some farmers to "no-till" practices, which involve planting seeds in the stubble of the previous crop rather than plowing each season, which can accelerate erosion [26] Farmers are using no-till on 11 million hectares in Brazil, up from 1 million in 1991, and on 9 2 million hectares in Argentina, up from 100,000 hectares in 1990 [27] In Latin America, the technique has cut soil erosion by as much as 90 percent [28]

Table 1: Selected Examples of the Consequence of Farmland Degradation

Reduced agricultural productivity	Degradation cut productivity by one third on half of India's soils In wheat-rice cropping systems of the Pakistani and Indian Punjab, degradation more than cancelled yield-enhancing effects of 40 years of technological change Yield reductions of 25–50 percent predicted in Argentina, Kenya, and Uruguay over next 20 years
On-farm expenses	Nutrient depletion costs sub-Saharan Africa about 7 percent of agricultural production a year in terms of equivalent amounts of purchased fertilizer Depletion amounts to $4 billion per year, much more than development assistance to African agriculture In the early 1990s, on-site costs of soil degradation cost South Asia $9 8–11 billion each year—7 percent of agricultural GDP
Salinization	Agricultural production threatened in virtually all the world's irrigated regions, particularly South and Southeast Asia Share of land in Bangladesh affected by salinization nearly quadrupled since 1990—from 9 to 34 percent In four villages in Uttar Pradesh, India, salinization and waterlogging reduced rice yield by 61 percent and wheat yield by 68 percent over 10 years
Off-farm expenses (air pollution, road damage, water pollution, desertification)	For 200 major dams worldwide, buildup of soil—sedimentation—costs $4 billion a year in reduced irrigation and hydropower and in additional maintenance Sandstorms from Inner Mongolia darken the air in Beijing and 20 other major cities in northern China, while dust storms from Africa blamed for spreading a soil-borne fungus to Caribbean coral reefs U S public benefits from erosion reduction, including higher farm productivity, reduced cleanup costs, and higher quality of water bodies, conservatively estimated at $1 4 billion a year

Source See endnote 13

Forest Loss Unchecked

Janet N Abramovitz

In 2001, the U N Food and Agriculture Organization (FAO) completed its latest Global Forest Resources Assessment and reported that during the 1990s "the world's natural forests continued to be converted to other land uses at a very high rate "[1] FAO estimated that at least 4 2 percent of the forest cover that stood in 1990 was gone by the end of the decade [2]

FAO found that 161 million hectares of natural forest were lost during the decade, and 152 million hectares of the loss occurred in the tropics [3] Only a small amont of natural forest loss was offset by regrowth—just 36 million hectares during the decade [4] Only 10 million hectares of that growth was in the tropics [5]

About half the Earth's original forest cover is gone, and another 30 percent has been degraded or fragmented, according to reliable estimates by the World Resources Institute [6]

During the last decade, the vast majority of the total forest cover loss—that is, loss of natural forests offset by regrowth or expanded plantation cover—reported by FAO occurred in just eight countries Brazil, China, Indonesia, Sudan, Zambia, Mexico, the Democratic Republic of Congo, and Myanmar (formerly Burma) [7] The forest cover of these eight together declined by 89 2 million hectares [8] Brazil alone lost 23 1 million hectares, China 18 1 million hectares, and Indonesia 13 1 million hectares [9]

***Links*, pp 70, 108**

In 2000, the world's forest cover stood at 3,869 million hectares, about 95 percent of which was natural forest and the rest plantation forest [10] Ten countries contain two thirds of the world's total forest cover the Russian Federation, Brazil, Canada, the United States, China, Australia, the Democratic Republic of Congo, Indonesia, Angola, and Peru [11] In terms of just natural forest, South America holds 24 percent of the total, the Russian Federation has 23 percent, and Africa, 17 percent [12] (See Table 1)

Today, 57 percent of the world's forests are tropical, 33 percent are boreal, 11 percent temperate, and 9 percent subtropical [13] Most tropical moist forests are in South America (58 percent), while 24 percent are in Africa, and 17 percent in Asia [14] Africa holds the largest share of tropical and subtropical dry forest (36 percent), while South America holds 30 percent of this forest type, and Asia has 21 percent [15]

Tree plantations expanded by 31 million hectares during the decade—and half of that came at the expense of natural forests that were removed to make way for the plantations [16] As of 2000, there were 187 million hectares of tree plantations [17] The lion's share—some 62 percent—is found in Asia, with China and India in the lead [18] Plantations now account for 21 percent of Asia's forest cover [19] At least half (48 percent) of the world's plantations are for industrial uses like lumber and paper [20] Over a quarter (26 percent) are for fuel or to protect soil and water [21] (The purpose of the remainder was not recorded)[22]

Many nations lost a high portion of their forests during the last decade Eighteen nations lost 20 percent or more of their forest cover, while another 16 lost 10–19 percent [23] Most of the highest losses were recorded in Africa Rwanda and Burundi each lost 39 percent, and Côte d'Ivoire, Sierra Leone, and Niger each lost about a third [24] Another troubled African nation, Liberia, recorded a 20-percent loss, although recent reports exposing widespread illegal logging may mean that this figure is low [25] El Salvador, Nicaragua, and Belize each lost between a quarter and a third of their forest cover during the 1990s, while Guatemala lost about 17 percent [26] (Some of the consequences of high deforestation were seen when Hurricane Mitch devastated Central America in 1998)[27] High-loss nations in Asia include Nepal, Sri Lanka, Pakistan, Myanmar, the Philippines, Indonesia, and Malaysia [28]

In order to manage forests more sustainably, forest monitoring must be improved, along with the way that official forest data are reported The FAO defines "deforestation" as a permanent conversion of forest to other uses (such as agriculture) or a long-term (10 or more years) reduction of canopy cover to less than 10 percent [29] Thus, a forest can be denuded or highly fragmented for nine years and still be counted as forest This highlights the difference between the official definition of defor-

Table 1: Natural and Plantation Forest Area, by Region, 2000

Region	Total Land Area	Natural Forest Area	Share of World's Natural Forest Area	Plantation Area	Share of World's Plantation Area
	(million hectares)		(percent)	(million hectares)	(percent)
Africa	2,978	642	17	8	4
Asia	3,085	432	12	116	62
Oceania	849	194	5	3	2
Europe	571	173	5	14	7
Russian Federation[1]	1,689	834	23	17	9
North and Central America	2,137	532	14	18	10
South America	1,755	875	24	10	6
World	13,064	3,682	100	187	100

[1] Included within Europe in original FAO data

Source U N Food and Agriculture Organization, *State of the World's Forests 2001* (Rome 2001), pp 37, 41, 152

estation and a more commonly understood use of the term The inclusion of plantations in estimates of global forest cover (even when those plantations replaced natural forest) can also lead to a distorted understanding of forest trends For its latest forest resources assessment, FAO revised many of the methodologies and definitions used, and thus cautions that the latest numbers cannot be compared with those from earlier assessments [30]

Better monitoring of the forests through use of satellite data and on-the-ground monitoring is also needed As FAO itself reveals, there are significant problems in the quality and comparability of the data it collects from individual countries The lack of on-the-ground forest inventories and scanty satellite monitoring are major barriers Three quarters of developing countries have either never carried out a forest inventory or have done only one, making accurate assessments of changes over time nearly impossible [31] Forest management and monitoring are chronically understaffed and underfunded in many nations

Independent monitoring groups play an important role in identifying forest conditions and assessing the veracity of official data For example, Global Forest Watch (GFW) and its network of in-country partner organizations have undertaken in-depth studies of several countries, including Canada, Cameroon, Gabon, Indonesia, and Russia [32] Forest Watch Indonesia and GFW reported in 2002 that Indonesia lost 40 percent of its forests since 1950, and in the last 20 years the rate of loss has doubled to about 2 million hectares per year [33] Other groups, including Global Witness, Greenpeace, Telepak, and the Environmental Investigation Agency, are also tracking illegal forest destruction [34]

In 2001 the U N Environment Programme (UNEP), in collaboration with NASA and the U S Geological Survey, produced an assessment of the world's remaining closed forests, which it defined as virgin, old growth, or naturally regenerated forests with a canopy density of greater than 40 percent It reported that in 1995 this category covered about 2 87 billion hectares [35] Together, Russia, Canada, and Brazil had 49 percent of this total [36] UNEP noted that about half of the remaining closed forests are "more or less intact," but echoed the assessment of many that "the remaining forests [are] very fragmented and under high pressure "[37]

Freshwater Species at Increasing Risk

Sandra Postel

Species that depend on rivers, lakes, wetlands, and other freshwater environments for a major portion of their lifecycle are being imperiled and extinguished at an alarming pace The principal culprit is the destruction of freshwater habitats by dams, river diversions, and pollution, along with the introduction of non-native species Because communities of freshwater species perform valuable ecological services—filtering and cleansing water supplies, mitigating floods and droughts, and delivering nutrients to the sea, for example—stepped-up efforts to stem the tide of biological decline are needed urgently

A comprehensive global assessment of freshwater biodiversity is not possible because of the lack of data for most countries But researchers estimate that at least 20 percent of the world's 10,000 freshwater fish species are now endangered, are threatened with extinction, or have already gone extinct [1] A significant but unknown share of mussels, amphibians, aquatic insects, and other species that depend on fresh water are also at risk Many species may be lost even before they are found or named indeed, scientists have been describing about 300 new freshwater species each year [2]

Link p 24

In North America, at least 123 species of freshwater fish, mollusks, crayfish, and amphibians have become extinct since 1900 [3] Biologists Anthony Ricciardi and Joseph Rasmussen estimate that in recent decades North American freshwater animal species have been extinguished at an average rate of half a percent per decade [4] They project, moreover, that this will increase in the near future to 3 7 percent a decade—about five times greater than the projected extinction rate for North American terrestrial animal species [5] In fact, the relative rate of loss of North American freshwater species is comparable to that of species in tropical rainforests [6]

The United States stands out as a global center of freshwater biodiversity The nation ranks first in the world in the number of known species of freshwater mussels, snails, and salamanders, as well as three important insect groups—caddisflies, mayflies, and stoneflies [7] U S waters are home to 300 species of freshwater mussels—29 percent of those known worldwide—and nearly twice as many as live in Europe, Africa, India, and China combined [8] With approximately 800 species of freshwater fish, the United States ranks seventh in freshwater fish diversity globally but has by far the most diverse assemblage of fishes of any temperate country [9]

In the most comprehensive survey to date of the conservation status of U S plant and animal species, researchers with The Nature Conservancy and the Association for Biodiversity Information found that of 14 major groups of organisms, the 5 with the greatest share of species at risk were all animals that depend on freshwater systems for all or part of their lifecycle [10] (See Table 1) An astonishing 69 percent of U S freshwater mussels are to some degree at risk of extinction or are already extinct —compared with 33 percent of flowering plants, 16 percent of mammals, and 14 percent of birds [11]

Although no comparable surveys exist for most of the rest of the world, the prognosis for freshwater life is not good Swedish scientists Mats Dynesius and Christer Nilsson have found that 77 percent of the 139 largest river systems in the United States, Canada, Europe, and the former Soviet Union—essentially the northern third of the world—are moderately to strongly altered by dams, reservoirs, diversions, and irrigation projects [12] Worldwide, the number of large dams (those at least 15 meters high) stood at 5,000 in 1950, and three quarters of these were in North America, Europe, and other industrial regions [13] By 2000, there were more than 45,000 large dams and they were spread among more than 140 countries [14]

Most new dam construction and major river diversions are occurring in developing countries as they strive to increase irrigation, water supplies, and hydroelectric power, much as industrial countries did before them Consequently, the rich diversity of freshwater life in tropical Asia, Africa, and Latin America will come under increasing pressure The

Table 1 Risk Status of U.S Animal Species Dependent on Freshwater Ecosystems

Animal Group	Total Number of Species	Share that is Extinct, Critically Imperiled, Imperiled, or Vulnerable
		(percent)
Freshwater Mussels	292	69
Crayfishes	322	51
Stoneflies	606	43
Freshwater Fishes	799	37
Amphibians	231	36

Source See endnote 10

Amazon basin alone harbors more than 2,000 species of freshwater fish—about one in five of those known worldwide—and scientists estimate that 90 percent are found nowhere else[15] With more than 70 dams planned for Brazil's Amazonian region alone, a good portion of these species are likely to be threatened[16]

Asia also has a diverse array of freshwater species coming under increasing threat from habitat destruction Indonesia has at least 1,200 freshwater fish species, China more than 700, and Thailand more than 500[17] Asian rivers are home to three of the world's five species of true river dolphins—those that never enter the sea—and all three are endangered[18] Tropical Asia also harbors the world's richest assemblage of freshwater turtles, as well as 8 of the world's 23 crocodilian species[19] All 8 are now endangered[20]

The ecology of Asian rivers is driven largely by the monsoons, which create high and low river flows at fairly predictable times of the year The organisms that inhabit these rivers have adapted and keyed their lifecycles to this flow pattern over time Dams not only block many of them from migrating up or down river, they smooth out the flow of rivers, thereby eliminating habitats and environmental cues that various species need to complete their lifecycles They also disconnect rivers from their floodplains, which many species rely on for breeding and feeding

Combined with pollution, watershed degradation, and the introduction of non-native species, additional dam construction will place a greater proportion of Asian freshwater species at risk In Southeast Asia, the Mekong Commission has identified a dozen sites for dams on the Mekong River in Laos, Thailand, and Cambodia[21] Dam construction continues in China, which already has nearly half of the world's large dams[22]

Finally, the algae, fungi, worms, and other species that live in freshwater environments are also at risk from the alteration of aquatic habitats Globally, more than 100,000 species of invertebrates are estimated to live in freshwater sediments, along with 10,000 species of algae and more than 20,000 species of protozoa and bacteria[23] These tiny sediment-dwellers help maintain water quality, decompose organic matter, produce food for animals higher in the food chain, and perform other critical functions Scientists have found them to be very sensitive to changes in water levels, flow magnitudes, and other hydrologic alterations[24]

Protecting the valuable ecosystem services upon which society depends requires conserving the unique assemblages of species that perform this work This, in turn, requires building habitat protection into the management and use of rivers A guiding principle now gaining ground is that of a freshwater "reserve"—the notion that ecosystems should be allocated the quantity, quality, and timing of freshwater flows needed to maintain their health and functioning[25] South Africa is pioneering the implementation of this principle following passage in 1998 of a new water act that calls for the establishment of ecological reserves for its rivers[26]

Transboundary Parks Become Popular

Lisa Mastny

In recent years, "transboundary parks" have become an important tool for conserving the planet's biodiversity and promoting regional stability These parks are formed when neighboring countries agree to link and jointly manage national parks, wildlife reserves, or other protected areas that are adjacent but lie on opposite sides of a shared border[1]

The earliest effort to unify two adjoining parks dates to after World War I, when the 1925 Cracow Protocol called for the creation of twin national parks along the then-disputed Czech-Polish border[2] Today, transboundary parks—also known as peace parks—are found on six continents, from South America to Asia

Links pp. 94, 104

In some cases, the level of cooperation between neighbors is highly formal in 1932, when the United States and Canada created North America's first transboundary park, the Waterton-Glacier International Peace Park, they signed an international treaty[3] Poland and Belarus, in contrast, have yet to forge diplomatic ties between their neighboring parks—Bialowieza and Belovezhskaya Pushcha—although they cooperate scientifically by exchanging plants and wildlife[4] And India and Bhutan coordinate only anti-poaching efforts in their adjacent Manas parks[5]

Opportunities for cross-border conservation are growing as countries designate new protected areas along their boundaries[6] Researcher Dorothy Zbicz estimates that in 1988, in only 59 sites worldwide did adjoining protected areas lay on opposite sides of a national border[7] By 2001, the figure had nearly tripled, to 169 sites[8] Some degree of transboundary cooperation already occurs at many of these locations, though typically at the lowest levels[9]

The sites straddle about a third of the world's more than 300 international boundaries and are distributed among 113 different countries[10] The majority of the sites span just two countries, but as many as 31 cover three nations[11] Most are located in Europe[12] (See Table 1) Altogether, these transboundary areas account for more than 10 percent of the currently protected land area worldwide[13]

In addition to the 169 sites, there are at least as many border locations where adjoining protected areas do not yet exist but could be established—creating hundreds of opportunities for future cross-border conservation[14] These include places where a park or reserve is found on only one side of the border, or on neither side, but where protection is still viable[15]

By establishing transboundary parks, conservationists hope to reconnect single ecosystems that have been artificially severed by political boundaries By one estimate, more than half of all international borders were drawn up arbitrarily by just six colonial powers, typically as an outcome of war or political compromise[16] Many of these borders bisect continuous deserts, forests, and watersheds, greatly increasing the political challenge of managing these areas[17] (The habitat of Africa's endangered mountain gorilla, for instance, is in a war-torn region shared by Rwanda, Uganda, and the Democratic Republic of Congo)[18]

Because of their large size, transboundary parks may be more effective than national parks at stemming species extinctions and protecting valuable ecological processes[19] For instance, they may be better able to support a more diverse gene pool for an animal or plant population, or to encompass the range required for large mammals like elephant or buffalo[20] Transboundary parks can also serve as important wildlife corridors, recreating ancient migration paths on land or water[21]

There are administrative benefits as well Often, park officials do not communicate or coordinate activities with their cross-border counterparts, though they may face similar challenges[22] By collaborating, parks can maximize efficiencies of scale and avoid duplication—sharing the costs for research, education, training, or equipment, for instance, or jointly combating illegal logging or wildfires[23]

The very process of linking protected areas can foster dialogue among long-distrustful neighbors[24] By one estimate, more than half of all countries share borders that are ill defined and contested[25] By collaborating through "peace parks," governments can boost regional security and build understanding and reconciliation among communities and institutions [26]

Arthur H Westing, an expert on transboundary conservation, argues that peace parks can boost political security in three general ways by reinforcing relations among friendly neighbors, by easing tensions among sparring neighbors, or by facilitating reunification of divided countries, such as the two Koreas [27] Already, provisions for peace parks have been incorporated into the treaty resolving the 1998 territorial dispute between Peru and Ecuador, and are also being used in negotiations between Israel and its neighbors [28]

The creation of transboundary parks can also boost the welfare of local people living in border areas, provided they are active participants in any revenue-generating activities [29] Communities living in and around southern Africa's newly created peace parks, for instance, hope to capitalize on joint tourism activities [30] Participating regions can also benefit from the cooperative management of shared resources, such as watersheds or fisheries [31]

But transboundary conservation still faces many obstacles Neighboring countries may share similar ecosystems, yet they often have quite different cultural and political values, forms of governance, and levels of stability [32] Their adjacent parks may vary in infrastructure and in some more localized problems [33] And the cost of unifying parks can be high funds may be needed for land purchases or leases, removal of fencing, staff, counter poaching, wildlife reintroductions, or community development projects [34] In most cases, however, the benefits of transboundary parks to nature and society will outweigh these costs

Table 1: Selected Opportunities for Transboundary Conservation, by Region

Europe (64 sites with adjoining protected areas)

At least 50 formal transboundary parks exist, many of which straddle the former Iron Curtain In February 2000, Albania, Greece, and Macedonia created southeastern Europe's first transboundary park, the shared Prespa Park wetland area

Africa (36 sites)

The continent's first peace park, the Kgalagadi Transfrontier Park shared by South Africa and Botswana, opened in May 2000 Four subsequent parks also span South Africa and its neighbors Efforts to link mountain gorilla reserves in Uganda, Rwanda, and Democratic Republic of Congo remain impeded by ongoing conflict

Asia (30 sites)

In September 1998, Russia, China, Mongolia, and Kazakhstan announced cooperation in conserving the shared Altai Mountains area In May 1999, Nepal and India agreed to join several parks to create a single wildlife corridor South Korea supports formally protecting parts of Korea's largely pristine demilitarized zone, though North Korea does not

Central and South America (29 sites)

The region's first transboundary park, La Amistad, was created in 1982 to promote peace between Costa Rica and Panama In 1988, Costa Rica and Nicaragua linked 51 different protected areas through their Si-A-Paz project A proposed Meso-American Biological Corridor could link existing protected areas in eight countries

North America (10 sites)

The region's first peace park, Waterton-Glacier, was established on the U S -Canadian border in 1932 In 1997, the United States and Mexico agreed to link adjoining parks in the Rio Grande valley Since 1990, Russia and the United States have considered creating a shared park bridging the Bering Strait, although the idea has faced political opposition

Source See endnote 13

Semiconductors Have Hidden Costs

Ann Hwang

In 2001, there were 60 million transistors produced for every man, woman, and child on Earth[1] These tiny components are used to build semiconductor chips, the brains behind many electronic devices computers, of course, but also cars, microwaves, cellular phones, vending machines, and even musical greeting cards By 2010, transistors will become even more pervasive, with 1 billion expected to be produced per person[2]

The semiconductor industry has grown explosively in the past two decades In 1982, annual sales of semiconductor chips totaled $14 billion[3] By 2000, sales exceeded $200 billion[4] Although the market contracted to an estimated $140 billion in 2001, the industry was showing signs of recovery in early 2002[5]

Links pp 82, 84, 112

As semiconductor technology has advanced, chips have become smaller, cheaper, and more numerous In 1972, one megabyte of semiconductor memory cost $550,000, today, it costs only a few dollars[6] (Most handheld personal organizers now contain eight megabytes of memory) The semiconductor industry has the capacity to produce 69 million wafers a year—each wafer holds anywhere from a handful to thousands of chips—with plants operating at 64–80 percent of capacity in 2001[7]

The production of these high-tech marvels requires the relatively low-tech ingredients of human labor and chemicals—lots of them Computer chips are created from silicon that has been refined, molded, cut, and polished (often with strong acids) into a thin wafer The electronic circuits that carry out the chip's functions are etched into the wafer's surface in a process akin to stenciling one set of chemicals is applied to mask parts of the surface, another to etch the exposed surface, and a third to remove the first set

The semiconductor industry is one of the most chemically intensive ever known[8] A single plant may use 500–1,000 chemicals[9] Manufacturing each silicon wafer not only requires tremendous amounts of chemical ingredients, it generates huge volumes of chemical waste (See Table 1) Santa Clara County, the birthplace of the semiconductor industry, now contains more U S Environmental Protection Agency (EPA) Superfund (toxic waste) sites than any other county in the nation[10]

Workers in the "clean rooms" where chips are made handle these toxic chemicals every day Clean rooms keep dust and other particles from spoiling the delicate silicon wafers, but are not necessarily clean for workers (In the United States, the semiconductor industry employed 284,000 people in 1999, around the world, the work force may exceed 1 million)[11] Women working in these rooms who handled reagents containing glycol ethers were found to have a 40-percent increase in their miscarriage rate compared with women without clean room exposure[12] Although semiconductor manufacturers have since phased out glycol ethers, little research has been done on the other chemicals that clean room workers are exposed to

To keep up in this fast-paced industry, companies may alter their manufacturing process without studying the long-term health and environmental effects of the new chemicals or processes Another challenge for occupational health researchers and providers is that workers are exposed to mixtures of chemicals, and relatively little is known about whether exposures to mixtures rather than single chemicals can have unexpected health effects

Efforts to fill some of these data gaps have at times met with reluctance, if not outright resistance, from the semiconductor industry In 1998, the EPA funded and the California Department of Health Services agreed to conduct a study of cancer and birth defect rates among the state's semiconductor workers[13] Despite the state's promise of confidentiality for workers and companies, the industry withdrew from the project at the last minute Intel spokesman Tim Mohin famously declared, "To participate in a project like this would be like giving discovery to plaintiffs I might as well take a gun and shoot myself "[14]

The threat of litigation is real IBM and National Semiconductor are facing lawsuits in California, New York, and Scotland[15] The

Table 1: Resources Required and Waste Produced Per Six-Inch Semiconductor Wafer

Resources Required	Waste Produced
90 cubic meters of bulk gases	1 1 kilograms of sodium hydroxide
0 6 cubic meters of hazardous gases	11,000 liters of waste water
8,600 liters of water	3 kilograms of hazardous waste
9 kilograms of chemicals	
285 kilowatt-hours of electricity	

Note Updated estimates unavailable Plant and company data suggest improved recycling and decreased releases, but industry wide efficiency could not be ascertained
Source Gordon Larabee, Texas Instruments, 1993, at <www svtc org/hightech_prod/ larachart htm>, viewed 30 September 2001

plaintiffs allege that years of exposure to toxic chemicals caused cancer and birth defects In January 2001, IBM settled out of court for an undisclosed amount with 15-year-old Zachary Rufling, who was born with multiple birth defects [16] Both of his parents had worked at an IBM plant in New York in the 1980s

Even at the end of their life cycle, semiconductors continue to pose environmental challenges Businesses and consumers now generate an almost continual turnover of electronic products In some American businesses, the rule of thumb has been "one computer per user per year" The short life span and increased number of these products are fueling a growing waste crisis Approximately 6 million tons of electronic waste were produced in the European Union in 1998 [17] This volume is expected to increase by at least 3–5 percent a year, or three times faster than the waste stream as a whole [18] In the United States, more than 2 9 million tons of e-waste ended up in landfills in 1997, with the amount predicted to increase fourfold in the next few years [19] But worse is yet to come at least 315 million computers in the United States are predicted to become obsolete by 2004 [20]

Increased recycling is part of the solution The National Safety Council estimates that in the United States in 1999, only 11 percent of discarded computers were recycled [21] In 2001, both IBM and Hewlett Packard announced U S recycling programs, which charge the consumer approximately $30 per computer [22] In April, faced with landfills rapidly reaching capacity, the Japanese government enacted an Appliance Recycling Law requiring consumers to pay manufacturers a fee to recycle discarded appliances [23] The law covers televisions, air conditioners, washing machines, and refrigerators, with computers to be added in the future And in June, the European Council approved a directive requiring manufacturers of electronic equipment to pay for the recycling of their products [24] (The European Parliament must now approve the directive before member countries turn it into law) A number of European countries already have mandatory take-back programs Depending on the country, costs are borne by consumers, municipalities, or manufacturers [25]

Bridging production and disposal through take-back programs may spur manufacturers to design products for easier disposal Currently, one obstacle to disposal is the high toxic load of many products A computer monitor, for example, contains 1 8–3 6 kilograms of lead, a heavy metal that damages the nervous system and poisons blood cell development [26] Monitors already account for nearly 40 percent of the lead in U S landfills [27] Cadmium, found in computer batteries, is recognized to increase the risk of cancer, damage the developing fetus, and harm the reproductive system [28] Flat panel screens contain mercury, which can form organic compounds that damage the developing nervous system [29] The logic is straightforward putting fewer toxic chemicals into electronic products will mean less hazardous waste to throw away later

Toxic Waste Largely Unseen

Anne Platt McGinn

Some 300–500 million tons of hazardous waste were generated worldwide each year during the past decade.[1] This amounts to roughly 50–83 kilograms per person in 1999 alone—and there is no end in sight.[2]

Under the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, wastes are classified as hazardous if they exhibit one or more hazardous characteristics and appear on a list of waste streams or if they contain specified hazardous constituents, such as asbestos, heavy metals, and several other chemicals.[3] (See Table 1.) Many industries create hazardous waste, including medical care, mining, petrochemicals, and pesticides and plastics manufacturing.[4]

Links pp. 82, 84, 110, 114

Industrial countries create more than 80 percent of the world's hazardous waste.[5] The United States is the largest producer, accounting for an estimated 260 million tons in 1997, including heavy metals, solvents, and toxic sludge.[6] By comparison, 39 countries that have ratified the Basel Convention reported generating 252 million tons of hazardous and other possibly dangerous wastes in 1998.[7] Russia and Uzbekistan accounted for half of this total.

Of the few countries that have filed more recent data with the Basel Convention secretariat, several reported increases in 1999.[8] China claimed a 2.6-percent increase in hazardous waste generation from 1998 to 1999, while the United Kingdom posted 20-percent growth during this time.[9]

Yet these self-reported data are an incomplete measure of the problem because fewer than one third of the 149 countries that have ratified the Basel Convention actually filed a national report with the secretariat in 1998, and many countries admit the data in these reports are unreliable.[10]

While hazardous waste generation continues with no signs of slowing, the global waste equation has grown more complex in response to the Basel Convention. The treaty aims to reduce cross-border movements of hazardous wastes while minimizing their generation, to promote disposal close to site of origin, and to prohibit trade with countries that lack the capacity to manage wastes in an environmentally sound manner.[11] In 1995, a group of developing countries and the European Union passed an amendment to the convention to prohibit the export of wastes from industrial to nonindustrial countries.[12]

This amendment is not yet legally binding (35 more ratifications are needed for it to enter into force), but most countries abide by its prohibition voluntarily.[13] The United States is a notable exception. U.S. officials have argued that the Basel ban may prevent some legitimate recycling activities and could inhibit trade.[14] (The United States signed the Basel Convention itself in 1989 but has not yet ratified it.)[15]

In addition to the global ban on exports, many countries have passed national laws and acceded to regional agreements to prohibit imports of hazardous wastes.[16] Regional bans in Africa and Latin America, for example, now forbid importing asbestos, unregistered pesticides, and other hazardous products.[17] As a result of these legal agreements, actual and attempted waste transfers between industrial and developing countries have declined significantly in recent years.[18]

Today, about 10 percent of all hazardous waste is moved across an international border, mostly among industrial nations.[19] The primary exporters are Australia, Germany, the Netherlands, the United Kingdom, and the United States.[20]

Canada has recently become a dumping ground for toxic waste in North America, owing to its less restrictive regulations.[21] Between 1993 and 1999, imports of hazardous waste to Canada from the United States and Mexico jumped 400 percent.[22] In fact, in 1999 Canada accepted more than twice as much hazardous waste from the United States as Mexico did.[23]

While hazardous waste transfers among rich nations continue largely unrestrained, waste shipments between developing countries are a growing concern.[24] Illegal trade is also ongoing and difficult to stop.[25]

The pressures that contributed to all this

Table 1: Hazardous and Nonhazardous Waste in the Basel Convention

List	Examples
Annex VIII of the Basel Convention—characterized as hazardous	Metal wastes and waste consisting of alloys of arsenic, cadmium, lead, and mercury Waste lead-acid batteries, whole or crushed Waste electrical and electronic assemblies or scrap Waste asbestos
Annex IX of the Basel Convention—not characterized as hazardous unless they contain hazardous materials	Iron and steel scrap Metal-bearing wastes arising from the melting, smelting, and refining of metals Other ceramic, solid plastic, paper, rubber, and textile wastes
Working list of wastes awaiting classification	Polyvinyl chloride (PVC) waste PVC-coated cables Residues from industrial waste disposal operations

Source UNEP, *Report of the Fourth Meeting of the Conference of the Parties to the Basel Convention* (Geneva 18 March 1998)

trade in the first place—increasing volumes of waste, higher disposal costs in industrial countries, and different national waste control standards—have increased since the mid-1990s[26] Without efforts to reduce the overall quantities of waste, progress achieved during the first decade of the Basel Convention could be undermined quickly

Because the treaty controls waste intended for final disposal but not for recovery or recycling, countries now prefer to label waste shipments for recycling[27] In 1998, an estimated 11 percent of exported wastes was burned, landfilled, or otherwise disposed of—while the other 89 percent was recycled[28] While this sounds like a preferable environmental option, many recycling and recovery operations are seen as a pretext for sending hazardous materials to countries for use in energy production, road building, construction, fertilizer manufacturing, and substandard and hazardous recycling operations[29] Such uses expose greater numbers of people to health risks and spread the contamination

Another form of toxic transfer is the relocation of industries and technologies that generate hazardous materials from industrial to developing countries[30] For example, the global shipbreaking industry has recently shifted its focus from industrial countries to Asia[31] Shipbreaking involves dismantling vessels contaminated with explosive gases, asbestos, PCBs, and other toxins Most of the world's shipbreaking is now done by migrant workers in Asia, with little or no health protections[32]

People who live near toxic waste dumps have reported increased vulnerability to certain cancers, birth defects, and low birth weight[33] Babies whose mothers lived within three kilometers of a landfill were found to have a 33-percent higher risk of congenital birth defects than babies living three to seven kilometers away, based on European data[34] One study concluded that living near a hazardous landfill poses the same risk of having a baby with low birth weight as smoking during pregnancy[35]

Despite the growing number of countries that have ratified the Basel Convention and its amendment and the global crackdown on trade between rich and poor countries, new hazardous waste continues to be produced at the rate of about a million tons per day and is transferred in many forms, largely unmonitored[36] Only by incorporating cleaner technologies and safer products can societies prevent the creation, use, and proliferation of hazardous materials and address the underlying causes of the ever-growing waste crisis

Rio Treaties Post Some Success

Jessica Dodson

The Rio Earth Summit in 1992 sharpened the world's focus on environmental issues, bringing them to the front of global consciousness to an unprecedented degree The World Summit on Sustainable Development in Johannesburg in September 2002 will surely remind the world of the promises made in Rio and the successes it can claim Since 1992, six major multilateral treaties have been adopted, while older agreements have been strengthened and refined by the addition of protocols and amendments [1] (See Table 1)

The six multilateral treaties, the so-called Rio Conventions, represent important advances in international environmental law[2] Despite a broad global consensus that environmental issues are a priority, many countries are reluctant to sign such treaties, particularly those requiring substantive changes in social or economic behavior [3] As result, in the post-Rio era, treaty drafters have increasingly used incentives in order to entice countries to take part [4]

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Since Rio, industrial nations have generally acknowledged a special responsibility for environmental degradation, and to secure the participation of developing countries in environmental treaties, they have agreed to finance part of any implementation costs But industrial countries also often need incentives to join treaties For instance, both Japan and Russia were offered a range of concessions in order to elicit their approval of a refined version of the Kyoto Protocol at Marrakech in November 2001 [5]

Along with incentives, environmental treaties now regularly include sanctions and penalties in order to enforce compliance Trade sanctions, used against states not abiding by their commitments in regimes such as the Montreal Protocol on the ozone layer and the Convention on International Trade in Endangered Species (CITES), remain an important enforcement tool Such measures are often a source of contention, as states balk at being held accountable for violations

There is also a potential for conflict between global free trade rules and the growing body of environmental law World Trade Organization (WTO) trade rules forbid restriction of the free circulation of goods, including goods whose production aggravates environmental damage As treaties continue to include trade-restriction clauses, the risk of violating WTO free trade rules grows [6]

While environmental diplomacy has unquestionably grown more sophisticated and prominent in the decade since Rio, have the new treaties stemmed the tide of environmental deterioration? In some cases, the compromises made during treaty negotiations may render treaty provisions too weak to address problems adequately—a charge frequently levied against the Kyoto Protocol [7]

In assessing outcomes, it should be noted that the more specific the obligation, the easier it is to actually judge compliance and measure the treaty's impact Thus adherence to the Montreal Protocol, CITES, or the treaty on persistent organic pollutants is much easier to measure than compliance with treaties on biodiversity or desertification, where obligations are broader and means of implementation not specified [8] The Montreal Protocol has been lauded as particularly effective in reducing the incidence of ozone-depleting substances, whereas phenomena such as the loss of biodiversity and the trade in endangered wildlife have continued or accelerated despite treaties intended to reverse these trends [9]

Although results clearly vary from treaty to treaty, most have had at least some positive effect on the problem they address [10] There remains ample room for improvement, however The proliferation of environmental agreements represents an unquestionable stride forward, but it may also provide a false sense of security that enough is being done Treaty effectiveness must be assessed through the systematic collection of data and information This will help analyze weaknesses in the environmental regime, design more effective treaties in the future, and pave the way for wider participation by eliminating the reticence fostered by uncertainty and denial

Table 1 The Rio Conventions

Convention on Biological Diversity, 1992 (182 parties)

Provides broad guidelines for the conservation of biodiversity at the national level and requires countries to formulate national biodiversity strategies and file national reports Recognizes national sovereignty over biological resources and principle of Prior Informed Consent before resources may be transferred out of a country, stipulating that biodiversity use must be sustainable and resulting benefits must be equitably shared between the source and receiving countries Subsequent Biosafety Protocol in 2000 (11 parties, requires 39 more to enter into force) provides strong enunciation of the precautionary principle, allowing states to decline to import products that "may contain" genetically modified organisms

U N Framework Convention on Climate Change, 1992 (186 parties)

Richest and most industrialized countries agree to adopt policies to stabilize greenhouse gas emissions at 1990 levels by 2000 Treaty introduces innovative procedures for implementation such as an emissions trading system, the Clean Development Mechanism, and Joint Implementation of commitments Subsequent Kyoto Protocol in 1997 (47 parties, requires at least 8 more, will enter into force when states representing 55 percent of 1990 carbon dioxide emissions have ratified) specifies 5 2-percent reduction in overall emissions from 1990 levels by 2012 and delineates other specifics of implementation procedures

Convention to Combat Desertification, 1994 (178 parties)

Designed to facilitate regional efforts to counter desertification, creates a network of four regions—Africa, Asia, Latin America and Caribbean, and Northern Mediterranean Each area can design and implement a plan tailored to local needs, but funding is primarily the responsibility of the afflicted states, with supplementary assistance from the donor community

UN Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 1995 (31 parties)

Entered into force in late 2001, advocates a cooperative, precautionary approach to management and conservation of relevant fish stocks Coastal states and those fishing in international waters must adopt national measures to restore stocks to levels capable of producing maximum sustainable yields Includes provisions allowing parties to board and inspect vessels of other parties on the high seas in order to verify compliance Also encourages regional planning and information exchange, recognizes the needs of developing states and subsistence fishers, and contains provisions on pollution control, related ecosystems, and domestic monitoring and compliance

Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, 1998 (18 parties, requires 32 more to enter into force)

Building on nonbinding procedures developed over 10 years, exporting states must receive explicit permission from importing states before shipments of 27 types of restricted substances may take place Safety and labeling requirements specified for the handling of these substances States refusing shipments containing a chemical must halt domestic production of the substance, avoiding conflict with trade rules

Stockholm Treaty on Persistent Organic Pollutants, 2000 (5 parties, requires 45 more to enter into force)

Regulates the production and use of 12 persistent, toxic substances The 9 Annex A chemicals are slated for elimination, while Annex B lists chemicals such as DDT that are subject to restricted use Also mandates the identification and elimination of stockpiles, products, and wastes containing persistent organic pollutants

Source See endnote 1

Economy and Finance Features

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Foreign Aid Spending Falls
Charitable Giving Widespread
Cruise Industry Buoyant
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Pesticide Sales Remain Strong

Foreign Aid Spending Falls

Hilary French

Ten years ago, the Rio Earth Summit attempted to bridge the interests of countries of the North and the South in forging a sustainable development path through what is sometimes called the Rio bargain The essence of this deal was that industrial and developing countries would agree to implement the range of environmental provisions contained in Agenda 21 and other Rio documents, but that industrial countries would provide substantial financial resources to help others accomplish this[1] As the World Summit on Sustainable Development in Johannesburg approaches, frustration is running high in many quarters over a failure of industrial countries to uphold their end of this bargain

Agenda 21, the lengthy action plan that emerged from the Rio conference, estimated that $125 billion in foreign aid would be needed to put the plan into practice, on top of substantially stepped-up spending by national governments[2] This sum was widely viewed as unrealistic at the time, as it amounted to twice the overall spending on foreign aid[3] But northern governments nonetheless agreed to strive to meet it, in part by reaffirming the commitments of many donor countries to contribute 0 7 percent of their gross national product (GNP) annually to development assistance[4]

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But in the decade since Rio, aid spending has declined substantially rather than increased According to Organisation for Economic Co-operation and Development figures, official development assistance amounted to $54 billion in 2000, down from $73 billion in 1992 (in 2000 dollars) (See Table 1) Aid spending as a share of donor nations' GNPs also declined, from 0 33 percent to 0 22 percent

Spending levels vary greatly by individual donor country In relative terms, Denmark leads the list, consistently contributing more than 1 percent of its GNP in aid, with the Netherlands, Sweden, and Norway following close behind The United States ranks as the least generous donor by this measure, spending just 0 1 percent of its national income

Several conditions are thought to have contributed to the decline in aid spending over the last decade, including the end of the cold war, large fiscal deficits in donor countries during the early to mid-1990s, and the growth of private capital flows into many parts of the developing world An additional factor has been growing skepticism from many quarters about the effectiveness of development aid in combating poverty and addressing other critical social and environmental challenges, particularly in countries beset by corruption[5]

Despite the shortcomings of many foreign aid programs, there can be little doubt that the overall decline in aid spending over the last decade has made it more difficult to fund key environmental and social programs adequately The Global Environment Facility (GEF) is a case in point GEF's mandate is to finance the additional costs that developing countries incur in responding to global environmental problems, including climate change, ozone depletion, the loss of biological diversity, the degradation of international waterways, and the spread of persistent organic pollutants[6]

Projects financed by the GEF have, among other things, helped Ethiopian farmers learn new ways to preserve genetic diversity in local agriculture, encouraged a partnership between an environment group, a local government, and a cement plant to preserve the Dana Nature Reserve in Jordan, and helped thousands of households, health clinics, and schools in some 20 countries to install solar power systems[7] Over the last decade, the GEF has committed $3 4 billion in grants to over 650 projects in 150 countries, an average of some $300 million per year[8] But raising even this relatively small sum from donor governments has proved to be a continuing challenge

Like the GEF, other environmental institutions have also suffered from scarce funding Budgets of the small offices charged with administering critical environmental treaties such as the Montreal Protocol and the biological diversity convention generally range from $1–10 million, and UNEP has struggled to maintain its annual budget of roughly $100 million[9] (In comparison, the U S Environmental Protection Agency had a budget of $7 8 billion in 2001, while the U.S. military budget was over $311 billion and global military expenditures in 2000 added up to more than $780 billion.)[10]

Programs aimed at reducing poverty and other pressing social problems are also starved for cash. For instance, in 2001 U.N. Secretary-General Kofi Annan called on donor nations to contribute $7–10 billion a year to a global fund to finance prevention and treatment programs for AIDS, tuberculosis, and malaria, three of the world's major killers.[11] Nine months later, the fund had attracted only $2 billion in pledges, and less than half of that is expected to be delivered in 2002.[12]

In September 2000, world leaders gathered in New York for the U.N. Millennium Summit, where they adopted a set of aggressive social goals for 2015, including halving the share of the world's people living in extreme poverty, suffering from hunger, and lacking access to clean drinking water, reducing maternal mortality by three quarters, and cutting child mortality by two thirds.[13]

Some $50 billion in additional aid spending will be needed to meet these targets, according to a report prepared for Secretary-General Annan as an input into the March 2002 International Conference on Financing for Development in Monterrey, Mexico.[14] If all donor countries were to meet the 0.7-percent goal, an additional $100 billion in annual spending could be raised—more than enough to cover these costs.[15]

Some governments and activists are pushing for donors to make a renewed commitment to the 0.7-percent aid target. The United Kingdom has been vocal on this score, with Chancellor of the Exchequer Gordon Brown calling in December 2001 for a "new Marshall Plan" to fight poverty and other social ills that threaten both human security and international stability.[16]

Table 1. Development Assistance Contributions, Top 15 Countries and Total, 1992 and 2000

Country	1992 Total (million 2000 dollars)	1992 As Share of GNP (percent)	2000 Total (million 2000 dollars)	2000 As Share of GNP (percent)
Denmark	1,621	1.02	1,664	1.06
Netherlands	3,207	0.86	3,135	0.84
Sweden	2,865	1.03	1,799	0.80
Norway	1,483	1.16	1,264	0.80
Belgium	1,014	0.39	820	0.36
Switzerland	1,327	0.46	890	0.34
France	9,634	0.63	4,105	0.32
United Kingdom	3,778	0.31	4,501	0.32
Japan	12,990	0.30	13,508	0.28
Germany	8,834	0.39	5,030	0.27
Australia	1,182	0.35	987	0.27
Canada	2,930	0.46	1,744	0.25
Spain	1,769	0.26	1,195	0.22
Italy	4,802	0.34	1,376	0.13
United States	13,640	0.20	9,955	0.10
All Countries	73,055	0.33	53,737	0.22

Source: Organisation for Economic Co-operation and Development (OECD), "ODA Steady in 2000, Other Flows Decline," 12 December 2001; OECD, Development Assistance Committee, *Development Assistance Committee Online*, updated 30 January 2002; OECD, Development Assistance Committee, *Development Co-operation 1993* (Paris: 1994), pp. 168–69.

Charitable Giving Widespread

Brian Halweil

The vast majority of people in the industrial world give money to charity, amounting to billions of dollars each year, although per capita giving varies widely among nations [1] (See Table 1)

Because of different tax laws and accounting methods, national statistics on charitable giving are not always comparable Statistics are most readily available for giving in the industrial nations of North America, Europe, and Asia, due to their greater wealth and better accounting But charitable giving seems to be a universal phenomenon In particular, informal modes of giving—through family ties, churches, and clothing and food donations, for example—are widespread in both rich and poor nations [2]

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Charitable giving is a proxy for how much people are concerned about community affairs or those less fortunate, but giving levels may also indicate social needs that are not being met otherwise For instance, since most charitable giving is for domestic causes, some researchers have suggested that the relatively low levels in Europe compared with the United States result from the higher tax levels and stronger social welfare policy in Europe [3]

Levels of giving are also affected by the economic situation, unemployment levels, and tax laws [4] Giving usually follows the movement of the economy—with more donations in boom times, and less in recessions [5] The enormous economic expansion in the United States between 1996 and 2000 coincided with a steep rise in giving, particularly among very wealthy individuals [6]

Historical trends in charitable giving are available for only a few nations, but generally show that while total giving has increased in real terms, giving per person has increased only modestly or declined [7] Canadians donated more than $5 billion to charities and nonprofits in 2000, for example, an increase of 11 percent since 1997, over the same period, donations by the average person rose 8 percent [8]

Over the last 30 years, giving in the United States has grown at an average rate of 2 6 percent (adjusted for inflation), more than doubling from $93 billion in 1970 to $203 billion in 2000 [9] Individual giving accounts for over 80 percent of all donations in the United States, with foundation and corporate donations providing 12 percent and 5 percent respectively [10] Since 1970, however, giving by foundations and corporations has grown more rapidly than individual donations The figure for foundations, adjusted for inflation, increased from $8 4 billion in 1970 to $24 5 billion in 2000, while corporate giving grew from $3 6 billion to $10 9 billion [11]

Foundation gifts are particularly dependent on the state of the stock market, since in the United States these organizations are required by law to give out a certain percentage of their total holdings This means that foundation giving has increased in recent years, but contracted severely with the stock market correction toward the end of 2001

Many nations do not have the tax structure to support giving or the organizations for people to donate to Before 1996, for instance, Canadians could claim tax credits for donations of up to 20 percent of their taxable income In 1996, the bar was raised to 50 percent of taxable income—and giving jumped 14 percent over the previous year [12] In Japan, where corporations enjoy considerably greater latitude and tax deductions from donations than individuals do, corporations contribute

Table 1 Individual Giving in Selected Industrial Nations, Late 1990s and 2000

Nation	Annual Giving Per Person (dollars)	Share of Population (percent)
Canada	259	91
United States	953	89
Netherlands	275	76
United Kingdom	180	68
Japan	15	n a
France	380	n a

Source See endnote 1

$3.7 billion each year compared with just $205 million by individuals.[13] (The latter figure is thought to be severely underestimated, however, because individual donations are not tax-deductible and are therefore not reported.)[14]

In the United States, individuals tend to give more, as a share of their total wealth, than corporations do. Individual donations in 2000 amounted to 1.8 percent of income, whereas corporate donations amounted to 1.2 percent of pretax income in the same year.[15]

In any given country, a relatively small group of people tend to account for the vast majority of donations. In Canada, for instance, the top 25 percent of donors were responsible for 82 percent of total donations in 2000.[16] Although the wealthy tend to give more in absolute terms, they generally give less as a percentage of their income. For example, Canadians with an annual income of less than $20,000 give nearly three times as high a share of their income as those with incomes of $100,000 or more.[17]

The likelihood of making donations increases with age, income, education level, religious involvement, and marriage.[18] In both the United States and Canada, people with a religious affiliation gave twice as much, on average, as donors without one.[19] And one survey indicated that college graduates donated 50 percent more of their income than high school graduates.[20] Surveys from several nations also indicate that women give more often and more generously than men.[21]

Although people in both Europe and North America give heavily to religion, North Americans particularly favor such causes. In Canada, more than half of all donations are made to religious organizations; health organizations and social service organizations captured 20 and 10 percent of the funds respectively.[22] In the United States, over one third of all giving went to religion, including half of the money donated by individuals; education and health were a distant second and third.[23]

In contrast, the Dutch give roughly 15 percent of total donations to each of the following: health organizations, sports and recreational organizations, social welfare groups, and international aid.[24] Medical causes receive almost one quarter of all British donations, while children and young people receive some 16 percent.[25]

Although most donations never cross a border—that is, most money is donated for local or national causes—international causes are increasingly popular, particularly in Europe. In the United Kingdom, international aid accounted for 9 percent of all donations, compared with just over 1 percent in the United States.[26]

Surveys indicate that people generally give because they feel compassion toward those in need, because they owe something to their community, or because they have been personally affected by a cause.[27] Sudden disasters—from earthquakes to plane crashes—can also prompt charitable giving. Sixteen percent of Americans who gave to charities associated with the September 11th attacks on New York and Washington had not given to any charitable cause in the previous year.[28]

People give in different ways, including donations of clothing or food or by volunteering their time. In 2000, 6.5 million Canadians—27 percent of the population aged 15 and older—volunteered for charities and nonprofits, an average of 162 hours per person.[29] The formal volunteer work force in the United States in 2001 represented the equivalent of over 9 million full-time employees, at a value of $239 billion.[30]

And the more money that an individual gives, the more likely he or she is to provide other types of support, including volunteering, giving directly to other people, and participating in community organizations.[31] In Canada, among the top 25 percent of donors in terms of total value given, almost half also volunteered time and nearly three quarters were members of an organization or group.[32] In contrast, of Canadians who did not give donations, just 11 percent volunteered and 28 percent belonged to organizations.[33]

Cruise Industry Buoyant

Lisa Mastny

The number of people taking a cruise vacation more than doubled between 1990 and 2000, to 9 8 million passengers annually, according to U K -based analyst G P Wild Ltd [1] (See Figure 1) The global cruise industry has grown on average 8 percent a year over the past decade, nearly twice as fast as tourism overall [2] Demand is expected to again double by 2010, to an estimated 20 7 million passengers annually [3]

Cruises were once a luxury for upscale travelers as recently as 1970, only about half a million people took one [4] But today many cruise lines offer inexpensive promotional packages as well as a wide range of on-board amenities to attract more mainstream tourists [5] Larger vessels resemble "floating cities," carrying more than 3,000 passengers and 1,000 crew, and boasting spas, conference centers, and even skating rinks [6] In 2001, the world's cruise fleet totaled some 163 ships, with an additional 42 new vessels slated for construction by 2005 [7]

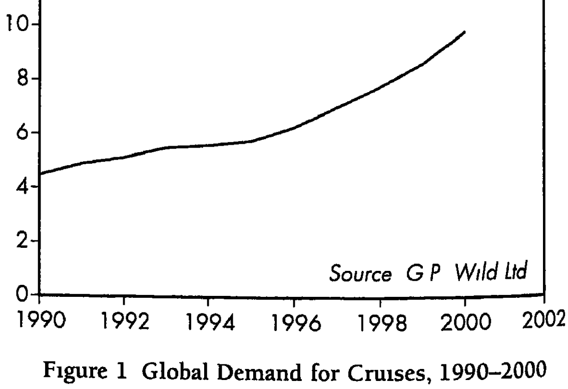
The world's four major cruise companies—Carnival Corporation, Royal Caribbean Cruises Ltd , P & O Princess Cruises, and Star Cruises—controlled roughly three quarters of the market in the late 1990s, earning combined revenues of $10 4 billion in 2000 [8] Industry concentration continued in late 2001, when Royal Caribbean and P & O Princess—which together carried more than 3 million passengers on 41 ships in 2000—announced a $6-billion merger to create the world's largest cruise group [9]

Nearly 70 percent of cruise passengers come from North America, while 21 percent come from Europe and the rest mostly from Asia and the Pacific [10] The Caribbean remains the top destination, accounting for 45 percent of global capacity, followed by the Mediterranean (13 percent), Europe (8 percent), Alaska (8 percent), and the U S West Coast (3 percent) [11] Since 1991, the number of passengers visiting Alaska has jumped by 10 percent a year, to 630,000 annually, cruises now account for about 80 percent of that state's tourism business [12] All told, cruise-related activities contributed $18 billion to the U S economy in 2000 [13]

But many cruise destinations, particularly in the developing world, do not see widespread benefits from vessel visits Port countries typically earn money from docking fees (which are often low), taxes, sales of fuel and fresh water, services such as waste disposal, and whatever passengers spend on shore [14] Yet with the rapid expansion of on-board offerings, many cruise passengers spend relatively little time or money at their ports-of-call [15] Meanwhile, most on-board restaurants and shops import food and supplies from the United States or Europe rather than buying locally [16]

Nearly all major cruise ship owners sail their vessels under foreign flags, taking advantage of lower corporate taxes and wages in many countries [17] Carnival Corporation, incorporated in Panama, paid just $19 million in taxes on $2 billion in operating income in the mid-1990s, while Royal Caribbean saves an estimated $30 million a year by registering its ships in Liberia and Norway [18]

Vessel re-flagging also makes it easier for ship owners to flout international labor, safety, or other standards by allowing them to register ships in countries with weaker laws or enforcement [19] The world's top cruise lines recruit as many as 90 percent of their employees from the



Source G P Wild Ltd

Figure 1 Global Demand for Cruises, 1990–2000

international work force—a single crew can have staff from as many as 60 nations[20] Some of these workers face 14-hour days and wages below $2 an hour, with little or no job security[21]

Ship operators are also notorious for lax adherence to laws regulating the disposal of sewage and other wastes[22] The San Francisco–based Bluewater Network reports that on a one-week voyage a typical cruise ship generates some 795,000 liters of sewage, 3 8 million liters of graywater (from sinks, showers, and laundry), 95,000 liters of oily bilge water, eight tons of garbage, 416 liters of photo chemicals, and 19 liters of dry-cleaning waste[23] Vessel smokestacks can emit high levels of air pollutants, including nitrous oxides, sulfur dioxide, and carbon dioxide[24] Overall, the world's cruise ships discharge some 90,000 tons of raw sewage and garbage into the oceans each day[25]

International maritime law permits vessels to release specified levels of pollutants overboard, provided the waste is treated or diluted or is discharged a certain distance from shore[26] Yet many cruise ships dump their wastes illegally—and most of this goes undetected In 1999, Royal Caribbean was fined a record $18 million for releasing excess oily bilge and other pollutants into U S waters and for attempting to cover up its crime[27] And a 2000 study of cruise ship effluents in Alaskan coastal waters found that 57 percent of sewage samples failed to meet U S federal standards for fecal coliform bacteria, while 68 percent failed to meet standards for suspended solids[28]

Cruise ships have other environmental impacts To accommodate larger vessels, many countries dredge deep-water harbors or modify their coastlines, destroying coastal ecosystems in the process And when ships dock, their massive anchors and chains can break coral heads and devastate underwater habitats in 1994, a scientist in the Cayman Islands reported that more than 120 hectares of reefs had been lost as a result of cruise ships anchoring in George Town harbor[29]

In an effort to clean up their acts, many cruise companies are trying to "green" their management and operations Simple steps include recycling plasticware and using recyclable and reusable containers[30] Some lines, like Holland America, are outfitting new vessels with on-board sewage treatment plants, incinerators, or co-generation incinerators that harness energy from waste burning[31]

In 2001, the International Council of Cruise Lines—a group that represents the top 16 cruise lines and whose members' 100 ships carry more than 7 million passengers annually—adopted new mandatory waste management standards[32] Companies risk losing membership if they violate the guidelines, which include rules for disposal of wastewater, batteries, and toxic chemicals and which call for better compliance with national and international environmental laws[33]

Many smaller cruise operators are embracing voluntary "codes of conduct" to regulate their impacts or are participating in schemes that certify good environmental practice[34] The 46 members of Antarctica's tour operators' association now follow a strict code that includes landing no more than 100 people per site at a time and making sure visitors do not disturb wildlife[35] And the new SmartVoyager program in the Galapagos has so far certified 5 of the area's more than 80 cruise operations for voluntarily meeting benchmarks set for maintenance and operations, docking, and fuel and wastewater management[36]

Governments are also taking action New legislation in Alaska, for instance, regulates graywater and airborne emissions from larger cruise vessels, allows inspectors to fine violators, and charges $1 per passenger to fund state pollution control[37] But the rules exempt certain hazardous wastes, and critics worry that the continued rapid rise in passenger numbers could outweigh regulatory efforts[38]

Ecolabeling Gains Ground

Lisa Mastny

As the demand for environmentally friendly products grows, manufacturers, governments, and nongovernmental groups have expressed rising interest in "ecolabeling"[1] Ecolabels are seals or logos used to indicate that a product has met a specified set of environmental or social standards[2]

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Although ecolabeling schemes vary widely, they typically reward a product for its environmental soundness during one or more stages of its life cycle, including production, packaging, use, or disposal[3] Some programs focus on a single product the Mexico-based Forest Stewardship Council, for instance, grants its seal to wood products that have met certain social and environmental standards during harvesting, manufacturing, and distribution[4] In contrast, the U S -based Green Seal program evaluates and certifies a wide range of products, including paints, engine oil, and air conditioners[5] Worldwide, ecolabels can now be found on everything from organic foods to tourism destinations[6] (See Table 1)

Ecolabeling programs exist at the national, regional, and global levels The first national scheme, Germany's Blue Angel, was launched in 1978 and now awards its seal to some 3,900 products and services—from batteries to car washes[7] Subsequent programs include India's Ecomark and Singapore's Green Label, both developed in the early 1990s[8] Currently, at least 24 countries have national ecolabeling programs, and many more are developing them[9] At the regional level, schemes include the Nordic Swan, which certifies more than 3,000 different products in Europe's Nordic countries, and the European Union's Flower Eco-label, which has been applied to 400 products[10]

Ecolabeling schemes serve a dual purpose They can help encourage the design, production, marketing, and use of more environmentally sound products and services[11] But they also provide consumers with valuable information about the range of preferable products, helping them to make more informed purchasing choices[12] A 1996 Green Gauge poll found that 45 percent of Americans had bought specific products because the labels stated they were environmentally safe or biodegradable[13]

The most effective ecolabeling programs have been developed with input from consumers as well as industry and environmental groups[14] Independent certification bodies evaluate whether a product conforms to a set of meaningful and consistent standards for environmental protection or social justice[15] Certifiers can include government agencies (such as the U S Department of Agriculture), nongovernmental groups (the Rainforest Alliance), professional or private groups (Green Seal), or international accreditation bodies (the Marine Stewardship Council)[16]

Ecolabeling works best when the labels rely on a set of clearly defined and verifiable standards—such that a single label means the same thing if used on a wide range of products[17] For many product areas, however, several competing ecolabels now exist, creating the potential for consumer confusion For instance, at least three different bodies worldwide independently certify sustainably harvested wood, and more than 100 schemes reward environmentally or socially responsible tourism[18] One way to resolve this problem is to develop a universal labeling standard for a specific industry or product, though this is generally a challenge[19]

Ecolabeling faces other obstacles Critics worry that some schemes rely on a relatively low standard, in order to reach out to more manufacturers and to spur greater interest in producing or buying environmentally preferable goods[20] For instance, the U S government's Energy Star label, which rewards energy-efficient appliances and other products, is so inclusive that in 1995 an estimated 85–90 percent of computers qualified for it[21] But the program's inclusiveness may prevent it from spurring the development of more cutting-edge energy-saving technologies[22]

Ecolabeling faces economic challenges as well Many certification schemes charge a fee for evaluation, which may be too high for smaller companies or producers and can limit expansion of the market[23] Companies may also pass the costs of certification on to consumers, boosting the prices of ecolabeled products[24] And there is concern that programs that rely on self-certifying may simply allow companies to "buy" their way to a green label[25]

Consumers also need to distinguish genuine ecolabels from more general claims manufacturers make about the environmental soundness of their products Many of these claims—such as "dolphin-safe," "antibiotic-free," "biodegradable," or "elemental chlorine-free"—may be accurate, but they are not always independently verified[26] At times, the labels can be highly ambiguous and may only confuse consumers, as with products that claim to be "environmentally friendly" or "Earth smart"[27]

Moreover, just because a product carries an ecolabel does not mean it is necessarily the most environmentally sound option In some cases, reusing or doing without may be environmentally preferable to buying a labeled product (reusing a cloth towel instead of buying recycled paper towels, for instance)[28] And some products may be awarded ecolabels even though the overall environmental track record of the manufacturer is poor[29] Ecolabels can also be relatively narrow in scope, focusing only on one specific attribute a label may reward a product for its energy efficiency, but hide the fact that it also contains toxic materials[30]

Ultimately, the success of ecolabeling will depend on whether trusted, reliable standards can be set and on the degree to which the industry and consumers embrace it worldwide

Table 1: Ecolabeling Schemes for Selected Products

Product	Example	Description
Forest products	Forest Stewardship Council	Grants its logo to products obtained from forestry operations that meet specified standards for sustainable management and harvesting Has certified more than 25 million hectares of forests in 54 countries
Agriculture	Rainforest Alliance's Conservation Agriculture Network	Awards its logo to coffee, banana, cocoa, and citrus farms that adhere to specified environmental and social standards As of June 2001, had certified 51,600 hectares on 218 farms or cooperatives in nine countries, mainly in Central America
Seafood	Marine Stewardship Council	Awards its logo to fisheries that meet a set standard for environmentally responsible management and practice Has certified six fisheries so far for rock lobster, cockles, hoki, mackerel, herring, and salmon
Coffee	Smithsonian Migratory Bird Center	Awards its Bird Friendly® seal of approval to coffees from Latin America that have been independently certified to meet specified standards for shade farming and organic production
Energy	Green-e-Renewable Electricity Certification Program	Rewards electricity services that obtain at least half their supply from renewable sources, the first voluntary certification and verification program for green electricity in the United States
Tourism destinations	European Blue Flag Campaign	Awards a yearly label to some 2,750 beaches and marinas in 21 European countries for their high environmental standards and sanitary and safe facilities Credited with improving the quality and desirability of European coastal sites Also being adopted in South Africa and the Caribbean

Source See endnote 6

Pesticide Sales Remain Strong

Brian Halweil

Although down slightly in recent years, global pesticide sales have increased 15-fold since 1950, from $2.8 billion (2000 dollars) in 1950 to $42 billion in 1999.[1] (See Figure 1.) Sales for agricultural use increased from $1.8 billion to just over $30 billion in the last half-century, while sales for industrial applications—including home and building pest control, road and highway use, and golf course maintenance—have grown from just under $1 billion to $12 billion.[2]

The growth of agricultural pesticide sales has slowed in recent decades, declining from an average of 8–10 percent per year in the 1960s and 1970s to under 2 percent in the 1980s and virtually no growth during the 1990s.[3] Agricultural markets are nearly saturated in the industrial world, which accounts for 65 percent of global sales.[4] Industrial uses of pesticides, however, which now account for more than one quarter of total pesticide use, continue to expand at more than 3 percent each year.[5] By 2010, industrial sales are projected to represent 30 percent of the total market.[6]

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The United States is about 40 percent of the world market for household pesticides, with annual sales exceeding $1 billion.[7] China is the second largest market for this category, with $580 million in sales.[8] Americans also lead the way in garden pesticide purchases, with annual sales of $1.5 billion, followed by the United Kingdom at $155 million.[9] Of the $850-million-dollar market for "turf" pesticides, roughly half is used on the world's golf courses and most of the remainder gets applied to American lawns.[10]

North America, Europe, and Japan account for 65 percent of global agricultural pesticide sales. The United States, Japan, and France alone account for over 40 percent of global sales.[11] Latin America buys about 13 percent of these products, while Asia (excluding Japan) purchases about 12 percent.[12] Although industry analysts project little agricultural pesticide sales growth in the industrial world, Latin America and developing Asia are growth markets, expanding at between 3 and 6 percent a year as farmers in these nations rely increasingly on farm chemicals.[13]

The regional breakdown of agricultural sales depends not only on the crops being grown (and the prevailing diseases of those crops), but also on climate and the structure of food production. For instance, the highly mechanized farms of North America depend on widespread herbicide use, a situation reinforced by the recent introduction of crops genetically engineered to tolerate spraying; this region accounts for 40 percent of global herbicide sales.[14] On the other hand, insecticide and fungicide use are concentrated in the tropics and subtropics, where warm, wet conditions exacerbate insect and fungus outbreaks.[15]

Five crops—rice, corn, wheat, cotton, and soybeans—account for over half of all agricultural pesticide sales.[16] As a group, fruits and vegetables account for another quarter of use.[17]

At over $14 billion, herbicide sales capture nearly half of the global agricultural pesticides market.[18] Insecticide sales are nearly 30 percent of the market, while fungicides are nearly 20 percent.[19]

Because companies are reluctant to report quantities of pesticides sold, statistics on total use are not widely available; moreover, different compounds can vary in application rate by a factor of 100, making year-to-year comparisons difficult. Still, global use has been esti-

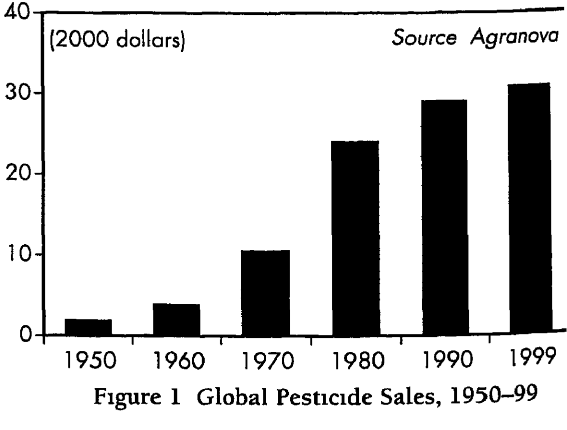

Figure 1. Global Pesticide Sales, 1950–99

mated at between 2 6 million and 3 5 million tons per year, up roughly 10-fold since 1950[20]

Two companies—Syngenta (formed by the merger of the agrochemical divisions of Novartis and AstraZeneca) and Pharmacia (which recently absorbed Monsanto)—control 34 percent of the global agricultural chemical market[21] The top 10 firms, all based in Europe, the United States, and Japan, control 84 percent of the global market[22] Nearly all these companies are also heavily invested in biotechnology, reinforcing the use of farm chemicals in conjunction with genetically engineered seed[23]

Worldwide, pesticide exports have grown from $1 3 billion (in 2000 dollars) in 1961 to over $11 4 billion in 1999[24] Because national pesticide legislation varies around the world, countries will sometimes export compounds banned domestically Of the 1 45 billion kilograms of pesticide exported by the United States—the largest exporter after Germany and France—between 1997 and 2000, nearly 30 million kilos were either forbidden or severely restricted in the United States[25]

The World Health Organization estimates that every year 3 million people suffer from severe pesticide poisoning, matched by a greater number of unreported, mild cases that result in acute conditions such as skin irritation, nausea, and diarrhea[26] And as many as 220,000 people die from pesticide poisoning[27] For many of these compounds, the long-term health effects are poorly understood or unknown, particularly in the combinations of chemicals that humans usually encounter

The U N Food and Agriculture Organization recently estimated that more than 500,000 tons of obsolete pesticides—old and unused pesticides that have been banned—have been stockpiled in the developing world and the former Soviet Union[28] These stocks, which contain some of the most dangerous chemicals ever produced, threaten the health of millions of people, leak into the environment, and contaminate farmland and drinking water[29] The United Kingdom spends roughly $200 million each year to remove pesticides from drinking water, equal to one quarter of what British farmers spend on pesticides themselves each year[30]

Moreover, our pesticide use is becoming less effective as overuse has helped kill off all but the most resistant bugs[31] For example, in the United States, the share of the harvest lost to pests has increased from 30 percent in the early 1940s to 37 percent in the 1990s—despite a 10-fold increase in pesticide use[32] The annual cost of this resistance, in terms of additional crop losses and chemical expenses, is nearly $2 billion—equal to one fifth of what American farmers spend on pesticides each year[33]

The health and environmental tolls of pesticide dependence, combined with the widespread emergence of resistant pests, have increased interest in organic farming and nonchemical approaches to pest control Following farmer-field schools on insect ecology and nonchemical pest control, for example, and higher taxes on certain pesticides, 2 million farmers in Viet Nam have cut pesticide applications from 3 4 to just 1 per season, with no drop in yields[34]

In Switzerland, where a radical restructuring of agricultural policy means that farmers must meet certain ecological standards in order to receive subsidies, pesticide use has fallen by one third in the last decade[35] And in Ontario, Canada, a program to train vendors and users of pesticides in the basics of nonchemical pest control, pesticide safety, and pesticide regulations resulted in a 40-percent reduction in the amount of pesticides used on farms since 1987[36]

Resource Economics Features

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Biotech Industry Growing
Appliance Efficiency Takes Off
Water Stress Driving Grain Trade

Biotech Industry Growing

Brian Halweil

In every nation for which there are data, biotech revenues and investments are soaring The combined annual revenues of biotech industries in the United States, the European Union, India, and Australia—which together account for the vast majority of the global industry—are now well over $35 billion[1]

The broadest definition of the biotechnology sector, also known as the "life sciences" industry, encompasses any activities that use genetic engineering, DNA analysis, and other modern biological techniques for applications within medicine, agriculture, chemical manufacturing, and other industries[2] (See Table 1)

***Links:* pp 26, 126, 138**

Revenues of the U S biotech sector, which dominates the world market, increased from under $5 billion in 1989 to $25 billion in 2000[3] The American biotech giant Amgen is almost as big as the entire European sector, the world's second largest market[4] The total U S industry is likely much larger, since Ernst & Young, the source of these figures, defines the industry as companies strictly engaged in biotechnology, excluding chemical, pharmaceutical, or other companies that routinely use the technology[5] In 2001, for example, U S sales of pharmaceuticals derived from biotech were valued at over $25 billion[6]

The amount of money invested in U S biotechnology companies jumped from $45 billion in 1992 (the first year of significant investment) to $331 billion in 2000[7] In contrast, $71 billion was invested in publicly held biotech companies in Europe in 2000[8] Since the biotech index was launched by the American Stock Exchange in December 1994, it has outperformed the Nasdaq and the Dow[9]

Biotech revenues in the European Union were roughly $8 2 billion in 2000, up more than fourfold since 1996[10] The United Kingdom, Germany, France, and Switzerland have the leading biotech sectors there[11]

Growth of the biotech industry in the developing world is more concentrated, with significant industries in Brazil, Cuba, and India Cuba now generates about $100 million each year in revenues from vaccines, drugs, and other biotech products[12] The biotech market in India is valued at $2 5 billion, up fivefold from 1997[13]

A defining feature of this emerging industry is its seamless integration with pharmaceuticals, food, chemicals, cosmetics, agriculture, and other industries For instance, bioengineered organisms and enzymes are being used in an array of industrial processes, from beer and cheese making to chemical manufacturing, most laundry detergents produced in the United States now contain genetically engineered enzymes[14]

This phenomenon is particularly pronounced in the health sector, as pharmaceutical companies use biotech companies to expand research into new and potentially lucrative areas[15] In 1998, drug companies signed research or licensing agreements with biotech firms worth $4 billion, a figure that rose to $7 billion by 2000[16]

Medical products dominate global biotech sales In the United States, more than 90 percent of annual sales is for medical applications, including pharmaceuticals and human diagnostics (disease test kits, for instance)[17] In contrast, just 5 percent of sales involve agricultural products, including transgenic seeds—the biotechnology that has attracted most public attention to date[18] So far, biotech drugs have generated less public protest partly because drugs are taken voluntarily, they have a clear purpose, and they are not released into the environment

Many aspects of the life sciences industry have inspired protest because they raise ethical issues about equitable access to medical innovations and the right to own living organisms For instance, because the biotechnology industry depends so heavily on patents and other proprietary arrangements, various entities—from human genes to crop varieties—that were once considered the collective property of humanity are now the sole possession of private companies The number of biotech patents—claims on snips of DNA, genetically engineered crops, or biotechnological processes—granted each year by the

U S Patent and Trademark Office grew sixfold between 1985 and 1999 [19]

An additional concern is raised by industry consolidation The total value of mergers and acquisitions in the biotechnology sector jumped from $9 3 billion in 1988 to $172 4 billion in 1998 [20] The top five biotechnology firms, based in the United States and Europe, control more than 95 percent of the patents on gene transfer techniques [21] Monsanto seed varieties account for 94 percent of the global area planted in transgenic crops [22]

Perhaps the biotech applications that have generated the most controversy involve manipulating the very nature of human reproduction and human life In February 2001, a private biotech firm and a publicly financed international consortium of scientists simultaneously described a rough map of the human genetic code, which could eventually yield major insights into human health and development [23] Although the public effort's results are freely available, the private firm plans to patent and sell the discoveries in its map

Many nations ban both human cloning and the engineering of humans with traits that could be passed on to future generations, although several teams of scientists have announced plans to clone a human being in the near future [24] In November 2001, the United Nations called for a ban on human cloning [25]

Table 1: Various Applications of Biotechnology

Pharmaceuticals

From 1995 to 2000, nearly three times as many biotech drugs were approved in the United States as in previous 13 years By mid-2000, biotechnology industry had over 14 percent of the products in medicinal trials there, share projected to increase to 25 percent by 2010 Four biotech drugs have at least $1 billion in annual sales Epogen and Procrit (both for anemia), Intron A/Rebetron (a combination cancer treatment), and Humulin (a version of human insulin for diabetics)

Agriculture

Farmers planted genetically engineered (transgenic) crops on 52 6 million hectares in 2001, a 30-fold increase from 1996 Biotech being used to develop tree and other plant varieties, as well as livestock and fish, although no commercial products on the market yet Scientists have genetically engineered pigs to make their organs less likely to be rejected by humans, and have engineered livestock to secrete human drugs in their milk or urine, which some think could significantly lower the cost of drug production

Information Technology

"Bioinformatics" is the use of computers to make sense of biological data, today's computing power has already become indispensable for recording and analyzing the colossal information contained in genomes—whether by searching an individual's genes for a propensity for disease or a crop variety's genes for a tolerance to drought Computer chips are being developed that use strands of DNA to do computations, an application that some believe will help shrink the size and increase the power of microchips

Human Life

Scientists have suggested that embryonic stem cells—which form at an early stage of embryo development and have the ability to differentiate into any human cell—could help repair damaged human tissues and treat diseases Many of the same techniques used to work with stem cells can be used to create a human clone or to genetically modify a human embryo—evoking images of mass-produced babies and creation of different genetic "classes " In late 2001, one company announced that it had begun cloning human embryos in an effort to generate stem cells

Source See endnote 2

Appliance Efficiency Takes Off

Michael Scholand

National energy standards and labeling programs are being initiated and expanded in a growing number of countries to save energy and other resources, such as water The increasing global adoption of these programs is linked to the rapid uptake of domestic appliances in industrial and developing countries alike Between 1994 and 1998, global sales of selected domestic appliances averaged 4 8-percent annual growth [1] In China, in particular, appliance purchasing has grown dramatically More than 65 percent of city-dwellers in China now own a refrigerator and more than 90 percent a clothes washer, both up from less than 5 percent only two decades ago [2]

Links pp. 38, 46, 124

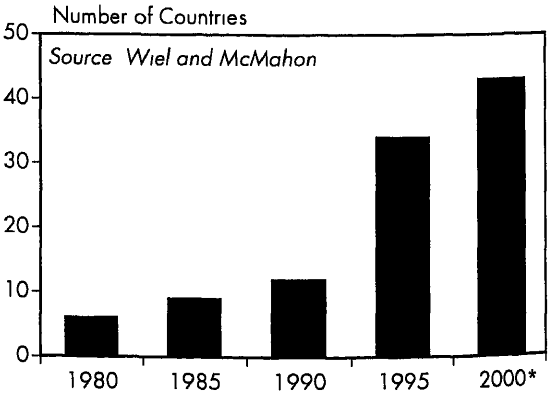
Domestic appliances improve quality and convenience in our lives, but they also consume a great deal of resources In part due to the increasing number of appliances, Chinese residential electricity consumption has grown on average 16 percent a year since 1985 [3] This has contributed to the addition of 16 gigawatts of new capacity every year to the Chinese grid—the equivalent of 32 medium-sized power plants [4]

The energy and water consumed in running all these appliances need not be so great If the market demands it, manufacturers will develop new and better products that perform the same services but have less environmental impact In many countries, however, consumers have precious little information about the energy or water consumption of the appliances they buy Effective labels are an essential first step in providing them with a tool to purchase more energy-efficient appliances Minimum efficiency performance standards (MEPS) are an accompanying measure that eliminates the least efficient models from the market, benefiting consumers through lower operating costs

Programs like these can now be found in 43 countries around the globe [5] The number of nations implementing programs has increased sevenfold since 1980, and more than tripled in the past decade (See Figure 1) Nearly half the programs are found in Europe, and 14 are in Asia [6] Europe's country count jumped in 1992, when the European Union (EU) launched a labeling and standards program that applied to all member states [7]

Appliance labeling and minimum standards are two different yet complementary strategies for achieving the same goal—reducing energy consumption Labels "pull" the market by providing consumers with information The label can be either a recognizable quality certification or a comparative scale or rating scheme These programs can be voluntary or mandatory, but they do not restrict any product from the market Minimum efficiency performance standards, in contrast, "push" the market and are based on the concept of consumer protection These standards are regulatory in nature, and often prohibit the sale of inefficient or poor-quality products

For more than two decades, appliance labeling programs have sought to inform consumers about product characteristics that may not be readily apparent [8] One example of this is the U S government's Energy Star program Whether affixed to a refrigerator, a fax machine, or a light bulb, an Energy Star label helps shoppers identify efficient products with lower energy costs [9] These products typically



*Includes four programs with unknown start dates

Figure 1 Countries with Appliance Efficiency Programs, 1980–2000

exceed federal efficiency standards by 13–20 percent, and sometimes by as much as 110 percent [10]

Labeling programs like Energy Star provide one measure of merit, whether a product is compliant or not Another major type of appliance label—comparative labels—provides a relative scale or ranking from which a consumer can compare energy consumption or some other performance characteristic These scales take many forms, such as a one- to six-star rating (in Australia), a scale from A to G (in Europe), or a sliding bar showing relative energy consumption (in the United States and Canada)

In Thailand, appliance labeling programs have had a considerable impact on energy use Comparative labels are credited with saving more than 100 megawatts of peak consumption to date Estimates suggest an additional 200 megawatts of peak hour savings by 2005 [11] The Thai refrigerator program has transformed the single-door refrigerator market, increasing the market share of units rated five stars from 12 percent in 1996 to 96 percent in 1998 [12] The air conditioner program has been slower, but still doubled the market share of the most efficient air conditioners from 19 percent to 38 percent in the same period [13]

After concluding that the U S EnergyGuide comparative label was difficult for some consumers to understand, the American Council for an Energy-Efficient Economy (ACEEE) launched a full-scale evaluation of the existing label and alternate designs [14] Working with consumers, retailers, and manufacturers, ACEEE developed a comparative label using a one- to five-star rating that it believes is more consumer-friendly and should make an impact in the market The U S government is expected to consider improvements to the EnergyGuide label in 2002 [15] The potential benefits of an improved label are clear if 20 percent of American consumers were influenced to purchase one of the most efficient refrigerators available, for instance, the electricity savings would eliminate the need for more than four large power plants [16]

The other essential tools for promoting more-efficient products, minimum efficiency performance standards, establish mandatory performance criteria either at a minimum level or a sales-weighted average The first confirmed account of these were refrigerator standards adopted by the French government that took effect in 1966 [17] Over the years, MEPS have a demonstrated track record of success In the United States, for example, they are credited with reducing the energy consumption of an average new refrigerator sold in 2001 by 75 percent compared with one manufactured 25 years earlier [18]

MEPS usually target the lowest ranking products on the market For example, the EU system of label categories (A to G) is referenced when setting a MEPS In 1999, the EU eliminated the lowest-ranking refrigerators and freezers (E, F, and G) from the market [19] From 1992 to 1999, the average energy use of cold appliances sold in the European Union fell by 27 percent, due to the energy label and manufacturers' improvements to meet the MEPS [20] A review of this program found that for each euro spent on the efficient refrigerator program, 100,000 euros in electricity savings will be realized by EU citizens between 1995 and 2020 [21]

Recognizing the synergistic strengths of standards and labels, a global initiative has been launched to promote further global adoption of these programs—the Collaborative Labeling and Appliance Standards Program (CLASP) Initiated in 1999, CLASP's mission is to promote the appropriate use of energy-efficient standards and labels for residential and commercial appliances, equipment, and lighting in developing and transitional countries [22] This program serves as both an information clearinghouse and a technical advice center, working globally to promote economic and environmental savings through energy efficiency standards and labeling

Water Stress Driving Grain Trade

Sandra Postel

As per capita water supplies drop below the level where it is possible or practical for countries to grow all their own food, numerous countries are satisfying their food demands by importing more grain. Collectively, water-stressed nations in Africa, Asia, and the Middle East now account for 26 percent of global grain imports—a figure that is likely to rise in the coming decades.[1]

Countries are classified as "water-stressed" when their per capita renewable water supply drops below 1,700 cubic meters per year. Typically countries in this situation do not have enough fresh water to meet the food, industrial, and domestic needs of their people.[2] Rather than importing water directly, they adapt to water stress by importing more of their food.

Links pp 26, 34, 60

It takes roughly 1,000 cubic meters of water—and considerably more than this in arid climates—to produce one ton of wheat.[3] Since grain is easier and more cost-effective to transport in large quantities than water is, water-strapped countries turn to world markets for a portion of their grain. They use their limited fresh water to support urban and industrial activities, which typically generate 50–100 times more economic value than the same quantity of water used in agriculture. The wealth-creating potential of this strategy has enabled some very water-scarce nations—Israel, for example—to achieve high standards of living.

The 36 nations in Africa, Asia, and the Middle East that are now categorized as water-stressed collectively import more than 68 million tons of grain a year.[4] With annual world grain imports averaging 260 million tons in recent years, these countries currently account for more than one quarter of global grain imports.[5] More than 20 water-stressed countries now rely on imports for at least one fifth of their grain consumption—and 15 use them for more than half. (See Table 1.)

In order for a strategy of relying on grain imports to work, at least two conditions must be satisfied. First, there must be enough surplus grain offered for export in world markets to meet the demands of the importers. Second, that grain must be available at a price the importing nations can afford.

There is good reason to be concerned about whether these two conditions will be met in the future. By 2015, seven more countries—including Ethiopia, Iran, and Nigeria—will join the ranks of the water-stressed.[6] Adding the projected populations for these seven to the population increases expected in countries already water-stressed yields the unsettling conclusion that by 2015 the number of people living in water-stressed countries will grow by more than 800 million—to nearly 3 billion, or 40 percent of projected world population.[7] As water stress deepens and spreads, more countries will be driven into the camp of net grain importers and those already in this camp will be driven by population and consumption growth to import more grain.

Just over the last five years, a number of water-stressed countries have increased sharply their dependence on grain imports. Morocco's import dependency (net imports as share of consumption) climbed from an average of 26 percent between 1994 and 1996 to an average of 51 percent between 1998 and 2000.[8] At the same time, Algeria's import dependency rose from an average of 70 percent to 77 percent, while Saudi Arabia's climbed from 50 percent to 73 percent and Yemen's from 66 percent to 78 percent.[9] Syria was actually a small net exporter of grain in the mid-1990s, but became dependent on imports for an average of 23 percent of its grain consumption in the 1998–2000 period.[10]

Moreover, three large countries that currently produce most of their own food—China, India, and Pakistan—are likely to be driven by water stress and other factors to join the ranks of the grain importers in the near future. China already has severe water problems in its agriculturally important Hai and Yellow River basins. The projected 2025 water deficit for these two basins is roughly equal to the volume of water needed to grow 55 million tons of grain.[11] As much as one fourth of India's grain production—some 45 million tons—is jeopar-

Table 1: Grain Import Dependence of Water-Stressed Countries in Africa, Asia, and the Middle East, Circa 2000

Country	Net Grain Imports as Share of Consumption[1] (percent)
Kuwait	100
Oman	100
United Arab Emirates	100
Lebanon	97
Israel	96
Jordan	91
Libya	89
Yemen	78
Algeria	77
Saudi Arabia	73
South Korea	71
Iraq	63
Mauritania	60
Tunisia	53
Morocco	51
Egypt	39
Azerbaijan	39
Somalia	37
Kenya	33
Syria	23
Ghana	21

[1] Ratio of annual net grain imports to grain consumption averaged over 1998–2000 Includes 21 of the 36 water-stressed countries importing at least one fifth of their grain

Source Global Water Policy Project, based on population data from U S Census Bureau and grain data from U S Department of Agriculture

dized by groundwater overpumping alone[12] Thus India and China could be headed toward combined grain imports of 100 million tons—more than the entire current U S supply of grain to world markets[13] Pakistan is plagued by shortages of Indus River water, groundwater overpumping, and serious salinization of its irrigated lands, and seems unlikely to remain food self-sufficient for long[14]

All in all, water stress will become a much bigger driver of the international grain trade in the coming years This will occur against a backdrop of land scarcity, urbanization, and other factors that also cause nations to rely more heavily on imported grain[15] As a result, the pursuit of food security by trading other goods and services for "virtual water"—perhaps a wise strategy for each individual water-stressed nation—may not be so wise when applied to all nations in this situation

In the absence of an international food aid bank or other global mechanism for filling food supply gaps, this may indeed be a risky strategy for poorer water-stressed countries that do not have the foreign-exchange earnings to handle large fluctuations in world grain prices The vast majority of the increase in water-stressed populations will occur in sub-Saharan Africa and South Asia, sites of the deepest pockets of hunger and poverty today

Sound strategies for coping with water stress need to include serious efforts to conserve water and use it more efficiently Much water continues to be wasted or used unproductively even in water-scarce regions In addition, ensuring that water scarcity does not translate into more hunger requires efforts well beyond a grain-import strategy Adequate levels of grain per person—whether achieved through domestic production or imports—does not alleviate hunger and malnutrition unless the hungry can afford to buy food or otherwise get access to it Improving the food-producing capabilities of poor farmers directly—through the spread of low-cost irrigation, for example—is a surer way of reducing hunger[16]

Health Features

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Food-borne Illness Widespread

Soda Consumption Grows

Prevalence of Asthma Rising Rapidly

Mental Health Often Overlooked

Food-borne Illness Widespread

Danielle Nierenberg

Food-borne illness is one of the most widespread health problems worldwide, and it could be an astounding 300–350 times more frequent than reported [1] (See Table 1) Although food-borne diseases strike up to 30 percent of the population in industrial nations each year, the infections are usually minor and easily treatable [2] Developing nations bear the greatest burden of this problem because of the presence of a wide range of parasites, toxins, and biological hazards and the lack of surveillance, prevention, and treatment measures that ensnarl the poor in a chronic cycle of malnutrition and infection [3]

Links: pp. 24, 28, 60

The World Health Organization estimates that more than 1 5 billion episodes of diarrhea occur each year in children under the age of five from ingesting tainted food and water, leading to more than 3 million deaths [4] For all ages, experts believe that 70 percent of diarrheal disease may be caused by food [5] Cholera can be spread by contaminated food or water, in 1997, 65 nations reported outbreaks leading to 6,000 deaths [6]

In the United States, food contaminated with bacteria, parasites, fungi, and viruses causes some 76 million illnesses, 325,000 hospitalizations, and up to 5,000 deaths annually, but because of underreporting the true figure is likely much higher [7] The United Kingdom has experienced a rapid increase—perhaps as high as fourfold—of reported food-borne illness in the last two decades, and similar trends are evident in Australia, Canada, Germany, Japan, New Zealand, the Netherlands, Sweden, and other nations that track food-borne disease [8]

Globalization, human migration, changes in eating habits, agricultural technologies, and environmental change can all influence the rise and spread of food-borne disease The combination of consumer demand for fresh fruits and vegetables year round and new trade routes means food is travelling longer distances to markets [9] Increased consumption of food bought from street vendors—and poor hygiene practices—help spread food-borne illnesses in the urban developing world [10] Hepatitis A can be spread by food handlers—an epidemic in China in the 1980s struck some 300,000 people [11]

It can be difficult to determine the primary sources of food-borne hazards In the United

Table 1: Selected Pathogens

Pathogen	Description
Camplyobacter	Half of infections are associated with eating contaminated poultry or handling chickens, the most common food-borne infection in the United States
Listeria	Present in soft cheese and meat pastes, for healthy adults it may cause no symptoms at all, but among pregnant women, infants, the elderly, and the ill, the death rate is about 30 percent
Marine Toxins	Poisonous marine life cause almost 45 percent of known food-borne disease in the Caribbean and Latin America Just one—*Ciguatera*—affects 50,000 people annually
Parasites	Amoebas—parasites spread by contaminated food and water—cause 100,000 deaths a year, second only to malaria in mortality due to parasites, 10 percent of the world is at risk of contracting trematodes, parasites found in raw freshwater fish, shellfish, and aquatic plants
Pathogenic *E coli*	Responsible for up to 25 percent of all cases of diarrhea among children and infants in the developing world, caused by consumption of food that has come into contact with fecal matter
Salmonella	Spread primarily through raw or undercooked eggs, poultry, and milk, accounts for the greatest proportion of food-borne disease in industrial countries

Source See endnote 1

States, most of these illnesses are a result of eating contaminated fish, shellfish, fruits, or vegetables, followed by meat and poultry products[12] In the United Kingdom, the culprit is meat and eggs[13] And in Cuba, the Dominican Republic, El Salvador, and Haiti, fish, water, and red meat are the top three major sources[14] Animal manure and human fecal matter are both common and growing contaminants of meat products and of fresh fruits and vegetables that are stored, processed, or shipped in unsanitary conditions

Traditionally, consumers have been blamed for food safety problems—accused of having poor personal and household hygiene, undercooking food, or not storing crops and food properly Aflatoxin (a type of mould), for instance, grows on crops kept in humid conditions It can lead to both fatal outbreaks of aflatoxicosis and high rates of liver cancer in some regions of Africa, Southeast Asia, and China[15] In one Chinese village, adults have a 1 in 10 chance of contracting liver cancer from eating contaminated grains[16] Botulism results from improper canning, and mortality rates are between 35 and 65 percent[17]

But many food safety problems start long before they reach the consumer According to the U N Food and Agriculture Organization, the trend toward increased commercialization and intensification of livestock leads to a variety of food safety problems[18] Crowded, unsanitary conditions and poor waste treatment in factory farms exacerbate the rapid movement of animal diseases and food-borne infections Samples of water downstream of one facility in Michigan contained 1,900 times the state's maximum standard for *E coli* in surface waters, and over 1, 000 people were sickened by *E coli* in Walkerton, Ontario, after the town's drinking water was polluted by nearby cattle operations[19]

Livestock feeds rich in starch but lacking hay—the standard diet in factory farms—have also been linked to the spread of food-borne pathogens, such as *E coli*[20] Factory-farmed poultry can disperse salmonella widely in the environment, polluting surface waters, the soil, and rivers[21] Heat-induced stress during the summer increases susceptibility to illness in factory farms, where animals are bred for their reproductive potential[22] Unfortunately, antimicrobial drugs mixed into the feed and water of cattle, chickens, and hogs to prevent disease have increased antibiotic resistance in bugs found in livestock and humans alike, making it increasingly difficult to battle emerging pathogens[23]

New technologies in agriculture, including pesticides, agricultural chemicals, and, more recently, genetic engineering, have the potential to create food safety disasters Bovine spongiform encephalopathy (mad cow disease), a virus caused by feeding cattle the renderings of other ruminants, can be spread to humans who eat infected meat To date, more than 100 people in the United Kingdom, France, and Ireland have died from new variant Creutzfeldt-Jakob disease, the human form of mad cow[24] Some experts predict that the number of victims could top 100,000 by mid-century[25]

Up to 200 Japanese sushi aficionados are poisoned each year by a toxin found in pufferfish, the mortality rate can be as high as 50 percent[26] And the tradition of eating bush meat in Gabon has helped spread the Ebola virus—a disease that can be spread by eating infected meat from primates and has a mortality rate of 90 percent[27]

Food-borne diseases have tremendous economic and societal costs They are the most frequent reason children are hospitalized in developing countries, and they lead to increased absenteeism from school and work, loss of income, and poor productivity[28] In the United States, the costs of just seven food-borne pathogens range between $5 6 billion and $9 4 billion annually[29] An epidemic of cholera in 1991 cost Peru more than $770 million in lost exports, decreased tourism, and food service closures[30]

Soda Consumption Grows

Erik Assadourian

In 2000, the global consumption of carbonated soft drinks (soda) reached 179 billion liters—29.4 liters per person.[1] (See Figure 1.) Soda maintained its ranking as the third most popular commercial beverage and edged closer to milk, which fell to 196 billion liters (32.2 liters per person).[2] While milk consumption fell 3.0 percent between 1999 and 2000, soda consumption grew 2.9 percent.[3]

The United States, with less than 5 percent of the world's population, is the largest soda consumer and accounted for one third of total soda consumption in 1999.[4] (See Table 1.) The 58 billion liters sold there generated $48 billion dollars in revenue for the soda industry.[5] Soda is already the number one drink for Americans, who took in an average of 211 liters of it in 1999—compared with 109 liters of tap water.[6]

Link p. 32

This rapid growth in soda consumption is also occurring in the developing world. China, with about a fifth of the world's population, is the fourth largest consumer of soda.[7] Between 1994 and 1999, per capita consumption in China grew 60 percent, to 7 liters per year.[8] Annual per capita consumption in Brazil, the third largest soda market, also shot up 60 percent between 1994 and 1999, reaching 61 liters per person.[9]

Unlike juices or milk, which contain vitamins and important minerals like calcium, soda consists of carbonated water, sweeteners (either caloric or high-intensity), flavoring, and in many cases caffeine. Consumption of these calorie-dense but nutritionally devoid drinks often displaces healthier foods, which can lead to dietary deficiencies.[10]

In the United States, as soda consumption doubled between 1970 and 1999, milk consumption fell 25 percent.[11] During this period, total calcium intake by children fell significantly.[12] A recent study found that children who drank soda took in a significantly smaller amount of vitamin A and calcium each day than those who drank milk.[13] As calcium is central to building strong bones, and as most bone mass in women is built by age 18, an increase in osteoporosis rates is a real threat.[14] A recent preliminary study found that drinking soda is significantly associated with increased prevalence of bone fractures in active adolescent women.[15]

As soda is a large source of added sugars and calories, it can also contribute to obesity. A recent study showed a direct correlation between consumption of sugar-sweetened drinks and childhood obesity.[16] The results suggested that children increase their odds of becoming obese by 60 percent with each additional sugar-sweetened drink they consume.[17] In America, overweight and obesity among children have tripled to 14 percent since 1970, and have increased to 61 percent among adults.[18] On average, Americans consumed about 185 calories from soda each day in 1999, which is more than the suggested daily maximum of added sugars.[19]

Soda consumption can also contribute to tooth decay. Although all sugars can cause tooth decay, soda is a primary concern because it is often consumed between meals or sipped over a long period, which prolongs the time that sugars remain in the mouth.[20]

Of the top 10 global brands of soda, more than 80 percent of the volume sold in 1999 contained caffeine.[21] This mood-altering drug

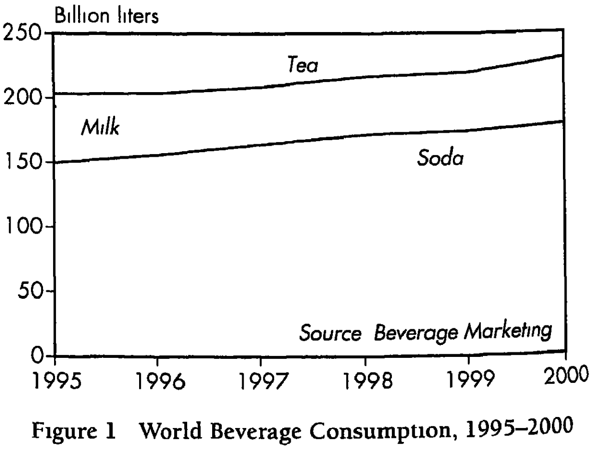

Figure 1 World Beverage Consumption, 1995–2000

is physiologically and psychologically addictive and can produce physical dependence with a daily intake of just 100 milligrams.[22] Coca-Cola, the world's most popular brand, contains 34 milligrams of caffeine per 355-milliliter can.[23] Because the effects of caffeine are weight-proportionate, a child will be more strongly affected by a small amount of caffeine.[24] While caffeine is supposedly added to enhance soda's flavor, a recent study found that only a small percentage of consumers were able to tell the difference between caffeinated and caffeine-free colas.[25]

Table 1: Market Share and Per Capita Consumption of Carbonated Soft Drinks, Top Five Countries, 1999

Country	Share of Global Market	Per Capita Consumption	Growth Per Capita, 1994–99
	(percent)	(liters)	(percent)
United States	33	211	10
Mexico	8	146	-3
Brazil	6	61	60
China	5	7	60
Germany	4	92	18
Top Five	57	53	15

Source: Beverage Marketing, *The Global Beverage Marketplace, 2001 Edition* (New York: 2001).

The soda industry aggressively markets its products. In 2000, the two largest soft drink corporations, the Coca-Cola Company and PepsiCo., spent $4.6 billion worldwide on advertising.[26] A significant portion of this directly targets children, often connecting soda with children's heroes. For example, Coca-Cola signed an exclusive $150-million global contract with Warner Brothers, the producer of *Harry Potter and the Philosopher's Stone,* to be the sole marketing partner for the movie.[27]

The soda industry also markets to children in schools, often signing exclusive marketing contracts with school boards, which in many cases tie monetary bonuses to a minimum amount of soda sold. In response, some schools have ended contracts after community objections.[28] In early 2001, Coca-Cola announced that it would start selling more nutritious beverages along with soda in U.S. schools.[29] Yet this change is probably as motivated by economic considerations as by grassroots pressure—recognizing that the U.S. soda market is saturated, Coca-Cola has started to diversify its product base to include other soft drinks such as water, juices, and sports drinks.[30]

With obesity becoming a global epidemic, health organizations and governments are trying to encourage healthier diets and lifestyles.[31] In a recent campaign, the Washington-based Center for Science in the Public Interest mobilized the health and education communities to "Save Harry Potter" from Coca-Cola and prevent children from being the target of an aggressive advertising campaign.[32]

Several countries have restricted the marketing of products to children. In Poland, for example, there is a ban on all television and radio marketing to children, which has significantly reduced product sales, including of soda.[33] Sweden also bans advertising to children on TV. But because of the strong presence of satellite TV, to which the ban does not apply, this has had less impact on consumption.[34]

In the United States, several states tax soda and other "junk foods." California, for example, has a 7.25-percent sales tax on soft drinks, which results in an annual revenue of $218 million.[35] Junk food taxes help reduce consumption of these unhealthy, often packaging-intensive foods and beverages. Further, while these taxes currently go to general funds, using them to counteract the huge advertising budgets of the soda and other junk food industries would help counter their pervasive messages and educate consumers about the importance of a healthy diet.

Prevalence of Asthma Rising Rapidly

Uta Saoshiro

Worldwide, an estimated 100–150 million people suffer from asthma today[1] On average, prevalence rates have been rising by 50 percent every decade[2] As one of the most common chronic diseases, asthma is increasingly being recognized as an international health problem[3] Though mortality due to asthma (at 218,000 in 2000) is significantly less than major killers such as tuberculosis (1 7 million), there are substantial social and economic costs related to asthma[4] Estimates of total family income spent on medical treatment range from 5 5–14 5 percent in the United States to 9 percent in India[5] It is also a major cause of school absences for children and lost work-days for adults[6] In 2000, the direct costs (hospitalization, physician and nursing care, and medication) and indirect costs (lost workdays for adults and lifetime earnings lost due to mortality) together in the United States were estimated at $12 7 billion[7]

Link p 148

Asthma is a chronic inflammatory lung disease, which makes a person much more sensitive to a variety of irritants and allergens[8] When exposed to these, the airways constrict, causing breathlessness, chest tightness, and wheezing[9] The symptoms, frequency, and severity of these attacks can be either mild or life-threatening, depending on the individual[10] Asthma often begins in childhood, when immunity systems are still developing and vulnerable[11] Although about one in four children eventually outgrows the disease, episodes early in life mean that a person is more likely to have recurring asthma as an adult[12]

In mild cases, a person could have attacks once a week, sometimes limiting physical activity and sleep In its severe form, asthma can be completely debilitating, characterized by continuous symptoms, frequent attacks, and significant limitation of routine activities—even walking up stairs[13] Factors that exacerbate asthma include viral infections such as influenza, physical exercise, breathing cold air, laughing or crying hard, certain drugs (for aspirin-sensitive asthmatics), and summer hay fever[14]

The first global study of asthma in children is being conducted in 56 countries[15] So far, the International Study of Asthma and Allergies in Childhood (ISAAC) found the highest percent of children with the disease in Australia, New Zealand, the United Kingdom, and the United States[16] (See Table 1) These countries also had a high number of people with asthma among adults aged 20 to 44[17]

The prevalence of asthma for the United States has more than doubled in just 16 years—from 6 8 million people in 1980 to 17 3 million in 1998, with deaths also doubling, to 5,637 in 1995[18] The number of asthmatics in Europe has also doubled in the past 10 years[19]

Although asthma is viewed as a problem primarily in industrial countries, an estimated 15–20 million people in India suffer from it as well[20] Children are particularly hard hit, with 10–15 percent of asthma in India occurring in children between the ages of 5 and 11[21] In Kenya, an estimated 20 percent of children have asthma, and the number varies from 20 to 30 percent in Brazil, Costa Rica, Panama, Peru, and Uruguay[22]

The global rise in asthma is "one of the biggest mysteries in modern medicine," says the World Health Organization (WHO)[23] The causes of the disease are complex So far the scientific community agrees that asthma results from a combination of genetic, environmental, and other factors[24] There is strong evidence that some people are predisposed to asthma because one or both parents have the disease[25] But researchers do not yet know which gene makes it more likely a child will develop asthma[26]

Repeated exposure to indoor allergens, such as dust mites, furry pets, cockroaches, and molds, is one of the biggest risk factors, especially in infants Outdoor allergens such as pollens and fungi can also be a problem These and other allergens sensitize a person's airways to irritation and can cause asthma[27]

Chemical irritants and allergens in the workplace are strong risk factors for adults[28] The dangerous agents include everything from flour for bakers to disinfectants for hospital workers[29] Exposure to passive smoking in the workplace is also a strong contributing factor,

Table 1. Asthma in Children, by Region

Region	Estimated Prevalence (percent)
Oceania	25 9
North America	16 5
Latin America	13 4
Western Europe	13 0
Eastern Mediterranean	10 7
Africa	10 4
Pacific Asia	9 4
Southeast Asia	4 5
Eastern Europe	4 4

Source See endnote 14

and has consistently been found to exacerbate asthma [30] This is also the case for children exposed to parental smoking, especially by the mother—the development of smaller lungs is typical of infants of mothers who smoke, thereby increasing the risk of the child developing asthma [31]

Air pollution, on the other hand, has yet to be established as a causal factor, although it is an important contributing factor, according to the ISAAC study [32] In areas with high levels of sulfur dioxide and particulate matter pollution (emitted mainly by coal burning for power and heating), such as China and Eastern Europe, the ISAAC study found a low rate of asthma among children (although the general prevalence of and mortality from other respiratory diseases, such as chronic obstructive pulmonary disease, are much higher) [33] Yet high rates in children were found in countries like New Zealand that have relatively low levels of air pollution [34]

WHO estimates that 30–40 percent of asthma may be linked to air pollution in some populations [35] But the precise role of different types of air pollutants remains ambiguous Different studies show that high levels of ozone and nitrogen oxide pollution can exacerbate existing asthma, while studies relating sulfur dioxide pollution to asthma are not as clear [36] Studies have also not controlled for other risk factors such as indoor allergen exposure, making it uncertain to what extent ambient air pollution affects asthma prevalence [37] Most recently, results from a 10-year study of children in southern California suggested that ozone pollution not only exacerbates asthma, but can also cause the disease in children [38]

Other factors, such as socioeconomic disadvantage, are associated with the higher prevalence of asthma From inner-city America to the urban slums of Nairobi, Lagos, and Kinshasa in Africa, the prevalence of asthma is much higher—for example, adult prevalence in these three African cities ranges from 7 to 10 percent, but is 15–20 percent in their slums [39] Factors such as inadequate waste disposal, poor housing conditions, and lack of access to proper medical care contribute to this state of affairs

Fortunately, an estimated 95 percent of asthma can be controlled by continuous medical care [40] In 1999 WHO added an anti-inflammatory drug, beclomethasone, to its essential drugs list (which tells countries the safe drugs for treating diseases affecting the majority of the world) [41] Even the most basic drugs are either unavailable or unaffordable in many developing countries, however [42]

Prevention measures such as not smoking, forgoing carpets and pets, or decreasing involuntary exposure to secondhand smoke can all improve overall respiratory health [43] A recent initiative in North Lanarkshire in the United Kingdom found that asthma patients' visits to the doctor dropped by two thirds when conditions favorable to house mites were eliminated by steaming carpets, renewing and cleaning bedding often, and installing better ventilation [44] Although the exact impacts of various air pollutants remain unclear, a precautionary approach would suggest the enforcement of clean air rules, as well as keeping children indoors on high pollution days [45]

Mental Health Often Overlooked

Danielle Nierenberg

In 2001, the World Health Organization (WHO) estimated that 450 million people worldwide had a mental or neurological disorder [1] Twenty-five percent of the population can expect to experience one or more disorders within their lifetimes [2] Mental illness is universal, affecting people in all nations and from every background, but poor people in developing countries lack access to many of the most basic resources for effective treatment

WHO's definition of mental health disorders is broad, encompassing a wide range of problems of both the mind and brain [3] (See Table 1) It includes autism, Alzheimer's disease, schizophrenia, depression, sleep disorders, addiction and substance abuse, bipolar affective disorder, panic and anxiety disorders, mental retardation, and epilepsy [4] (Although epilepsy occurs because of an electrical mix-up in the brain and retardation and autism are developmental problems, people with these conditions are often discriminated against and prevented from fully participating in normal social activities)

Links
pp 148, 156

Overall, mental disorders account for almost a third of global disability (the number of healthy life years lost to a disability) from all diseases [5] Depression is by far the most debilitating—more than 120 million people are affected worldwide [6] Currently, depression represents 12 percent of the global disability burden, and by 2020 its share is expected to rise 15 percent, second only to heart disease [7]

Although the incidence of depression is highest during middle age, experts recognize that the elderly and children are not immune to mental health problems The prevalence of some disorders—dementia and Alzheimer's—rises with age [8] In the United States, 1 in 10 young people suffers from impairment of psychological development or from behavioral, emotional, and depressive disorders [9] Roughly 18 percent of children and adolescents in Ethiopia have a mental disorder, while in India the figure is 13 percent [10] More than 20 percent of young people in Germany, Spain, and Switzerland are afflicted with depression, anxiety, or other mental problems [11]

Rural isolation and poverty can make things

Table 1: Selected Mental Health Problems

Disorder	Description
Depression	Twenty percent of cases never go into remission, recurrence rate after first episode is as high as 60 percent
Schizophrenia	Found equally in women and men, affects 24 million people worldwide
Substance abuse	Dependence on tobacco, alcohol, and illicit drugs affects millions of people and is a rising problem in developing nations
Epilepsy	Caused by excessive electrical activity in the brain—not dementia—it affects about 50 million people worldwide
Obsessive compulsive disorder	Characterized by uncontrollable anxious thoughts or rituals, more common than schizophrenia, bipolar disorder, or panic disorder and affects about 2 percent of the U S population
Eating disorders	Between 5 and 20 percent of people with anorexia nervosa, a disease characterized an intense fear of weight gain, die as a result of complications Other disorders, including bulimia nervosa and binge-eating, are becoming more common among young women and girls in non-western nations, such as Japan, Brazil, and South Africa

Sources See endnote 3

worse In remote regions, mental and general health care facilities or counselors are nonexistent or too expensive Rural women—who also suffer from economic hardship—are more than twice as likely to suffer from depression than the general population [12] Often the mentally ill, who carry the extra burden of being poor, wind up incarcerated In the United States, there are five times as many prisoners with mental illness as there are patients in state mental hospitals [13]

Changing societal norms can also bring out psychological problems as people are separated from their traditional social safety nets of family and community For instance, eating disorders—an increasingly common problem among girls (and more and more boys) in affluent nations—have spread to developing countries as cultural definitions of female beauty change [14] Dependence on a cash economy, overcrowding, pollution, and increased violence in cities can also exacerbate mental disorders [15]

Mental illness strikes men and women differently Almost 10 percent of women have a depressive episode every year, compared with fewer than 6 percent of men [16] Men, however, are more likely to have substance abuse problems and antisocial personality disorders [17] Severe mental disorders, such as schizophrenia, show no clear gender preference [18]

Mental illness often exacerbates and in some cases leads to other health problems Patients with untreated mental disorders who also suffer from other chronic conditions, such as cancer, HIV/AIDS, heart disease, or diabetes, are less likely to experience an improvement in overall health [19] And addiction to drugs, tobacco, or alcohol—which WHO also classifies as mental health disorders—can increase the severity and duration of mental illness Studies show that the mentally ill are about twice as likely as others to smoke [20] Alcohol abuse is on the increase in many of the world's developing regions, especially among indigenous groups, who previously had little exposure to intoxicants [21]

Suicide is the most tragic outcome of mental illness Nearly 1 million people end their lives each year and an estimated 10–20 million people try to kill themselves [22] Suicide—usually preceded by severe depression or schizophrenia—is a leading cause of death in young adults (15–34 years of age) in China and most of Europe [23] In the United States, farmers in the upper Midwest—a region plagued by economic hardship and the loss of small farms—are 1 5–2 times likelier than other groups of men to commit suicide [24] There is a strong correlation between violence against women and contemplation of suicide [25] WHO found that Japanese victims of domestic violence were more than 30 times as likely to commit suicide as women who were not abused [26] Battered women in the United States are five times more likely to commit suicide [27]

Available treatment methods for mental illness vary regionally and among socio-economic classes Use of psychotropic drugs—mostly in industrial nations—is rapidly increasing Antidepressants are the third most often prescribed drug, with sales of over $13 billion worldwide [28] The number of Americans taking medicines to treat their depression has risen by more than two thirds over the last decade [29] Unfortunately, many are not supplementing their drug therapy with counseling or other interactions with mental health professionals

In developing nations, however, therapeutic drugs for mental illness are usually unavailable to the general population As a result, many people end up hospitalized—often in crowded, unsanitary asylums where they are neglected and abused—for conditions that could be treated with drugs, therapy, or both Human Rights Commissions in India and Central America found that at least one third of the "inmates" in these hospitals were people with epilepsy or retardation, who need not be hospitalized [30]

Few nations have adequate mental health programs, and many lack even the most basic or rudimentary services WHO recommends that all nations provide treatment for mental illness as part of primary health care, launch public awareness campaigns to break stereotypes about mental illness, support community care of affected individuals, develop the human resources necessary to treat mental health care, and support research on mental illness [31]

Social Features

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Poverty Persists
Car-Sharing Emerging
Sprawling Cities Have Global Effects
Teacher Shortages Hit Hard
Women Subject to Violence
Voter Participation Declines

Poverty Persists

Molly O Sheehan

Even though average incomes more than doubled in developing countries between 1965 and 1998, 1 2 billion people—more than one in five in the world—lived on less than $1 a day in 1998, a level used by the World Bank to denote "extreme poverty" or lack of income to meet basic food needs[1] (See Table 1) Although the share of people in this category fell between 1987 and 1998, the total number remained almost constant as population surged

Roughly 70 percent of people surviving on less than $1 per day live in sub-Saharan Africa and South Asia[2] Sub-Saharan Africa has the largest share of extremely poor people, although there are tremendous differences within and between nations[3] The AIDS epidemic, which disproportionately kills people between the ages of 15 and 49, has worsened poverty in this region, as the disease takes the main wage earners in many families

Links: pp 88, 142, 144, 154

Rural areas house the bulk of the extremely poor, but the rural-urban income gap has been shrinking[4] In Nigeria, for example, Africa's most populous nation, a failing economy and massive migration toward cities in the 1990s meant urban poverty outpaced rural poverty[5]

Eastern Europe and Central Asia had the largest percentage increase of people living in poverty in the 1990s, following the breakup of the Soviet Union and the collapse of centrally planned economies In Russia, the share of people living beneath the nationally defined poverty line surged from 11 percent during the Soviet era to 43 percent in 1996[6]

Many thresholds of poverty exceed the $1-a-day measure In industrial countries, some 130 million people live in poverty as defined by earning half of national median income[7] In a recent book, a U S reporter chronicles three futile attempts from late 1998 to 2000 to maintain her health and dignity while earning $6–7 an hour, which is what some 34 million people living below the U S poverty line try to do[8]

Poverty is about more than income education and health reveal important distinctions between rich and poor[9] Despite progress in the last few decades, 854 million adults are still illiterate 2 4 billion people lack basic sanitation, and every day 30,000 children under the age of 5 die of preventable causes[10] The Human Development Index produced by the U N Development Programme (UNDP) includes adult literacy, educational enrollment, and life expectancy Most countries improved their ranking on this index between 1975 and 2000, but 20 nations in Africa, Eastern Europe, and the former Soviet Union actually fell backward on this scale[11]

Poor people are also disproportionately vulnerable to environmental risks, crime, and government corruption One fifth of the total burden of disease in the developing world is caused by environmental risks—from lack of safe water to exposure to industrial chemicals[12] When World Bank researchers consulted more than 60,000 poor men and women in 60 countries, many voiced frustration over their powerlessness to protect their families from threats like floods disease-carrying mosquitoes, thieves and crooked officials[13]

Not only has poverty persisted in the 1990s, but the chasm between rich and poor has widened[14] While three fifths of the world's people earn just 6 percent of the world's income, one sixth receives 78 percent[15] The gap between rich and poor shrunk in many countries between the 1950s and mid-1970s, but the reverse has happened since then[16] Of 73 countries for which good data exist, inequality rose between the 1970s and 1990s in 48 nations, including the United States, most of Latin America, Russia, most of the former Soviet bloc, China, and parts of Africa[17]

Extreme poverty in an era of unprecedented wealth is not merely shameful—it is dangerous Many recent studies have shown a correlation between more equal income distribution and better public health, with life expectancy higher in countries like Sweden, Norway, and Japan, where the poorest households receive a higher share of income than in other wealthy nations[18] Comparing U S metropolitan areas, researchers found a higher level of premature deaths in the places with the highest inequality[19] Poverty and inequality can also

Table 1: People Living on Less Than $1 a Day, Selected Regions, 1987 and 1998

Region	1987 Total (million)	 Share of Population (percent)	1998 Total (million)	 Share of Population (percent)
Sub-Saharan Africa	217 2	46 6	290 0	46 3
South Asia	474 4	44 9	522 0	40 0
Latin America & Caribbean	63 7	15 3	78 2	15 6
East Asia & Pacific	417 5	26 6	278 3	15 3
Eastern Europe & Central Asia	1 1	0 2	24 0	5 1
Middle East & North Africa	9 3	4 3	5 5	1 9
Total	1,183 2	28 3	1,198 9	24 0

Source World Bank, *World Development Report 2000/2001* (New York Oxford University Press, 2000), p 23

lead to political instability and social tensions that impede economic growth and spark fanaticism and violence [20]

Many nations are failing to meet international goals to reduce poverty [21] In 2000, world leaders meeting at the United Nations for a Millennium Summit committed to several laudable goals for 2015 halving the number of people living in extreme poverty, suffering from hunger, and living without safe water, reducing infant mortality by two thirds, and enrolling all children in primary school As of late 2001, 74 countries—with more than one third of the world's population—were not on track to halve poverty, and 83 countries, home to 70 percent of the world, were not on schedule to halve their share of people without access to safe water [22]

While many attempts to reduce poverty have focused on stimulating national economies, economic growth alone does not guarantee cuts in poverty or inequality A study of 47 developing countries between the 1980s and 1990s identified 117 growth periods, in 30 percent of these, the rapid growth did not affect poverty levels [23] China's coastal cities have gained from rapid economic growth in the past 20 years, but rural inland communities have not—and inequality has soared as a result [24] In the United States, the economic boom of the 1990s did not dent the nation's historically large income gap, even in prosperous metropolitan areas [25]

Improving the health and education of women and girls can help reduce poverty Although global breakdowns of poverty by sex are difficult to make, UNDP estimated in 1995 that women may account for as much as 70 percent of the world's poor [26] Some 64 percent of illiterate adults are women [27] When women lack education and health care, population growth can overwhelm capacities of countries to invest in needed social infrastructure [28] Greater economic opportunities arose in East Asian nations such as South Korea, Thailand, and Taiwan after population growth slowed, fostered by policies to promote family planning and the education of girls [29]

Accountable governments can also help alleviate poverty [30] Burdensome laws and corrupt officials thwart many from entering the "legal" economy Even in the poorest slums, people have built their own homes and businesses, but their lack of legal title to property prevents them from getting bank loans to further their progress More than half the population of large cities such as Cairo, Nairobi, and Bombay, for example, lacks legal residences [31] Economist Hernando de Soto estimates the value of real estate not legally owned in the developing world and former Soviet bloc nations at $9 3 trillion, all of which could be brought into the legal system and leveraged to reduce poverty [32]

Car-Sharing Emerging

Gary Gardner

Car-sharing, a subscription-based transportation service that makes cars available to its members, is taking off rapidly in industrial nations as environmentally conscious entrepreneurs tap the market for an alternative to owning or renting an automobile. Some 126,000 people share nearly 5,500 vehicles in car-sharing organizations (CSOs), primarily in Europe, but also in North America and Asia.[1] (See Table 1 and Figure 1.)

In most car-sharing organizations, participants have access to a fleet of cars parked at designated spots around town, often in a subscriber's neighborhood or at a major transit hub. Subscribers generally reserve a car in advance, although service on demand is possible if a car is available.[2] (In Switzerland, two thirds of surveyed members reported having a car within a 10-minute walk of their home, and 95 percent said they can get a car when they want one.)[3] Car sharers typically pay a refundable deposit, and sometimes a yearly membership fee.[4] They are also charged by the hour and by the kilometer for usage; these charges typically cover gas, insurance, and maintenance.[5]

***Links*: pp. 38, 74, 152**

Car-sharing experiments can be traced back at least to the 1970s, but growth really took off in the late 1980s, when CSOs opened in Switzerland, and then in Germany.[6] These two nations now account for roughly 80 percent of the world's subscribers. Germany is home to 56,000 car sharers using nearly 2,400 cars, and Switzerland claims 43,000 members and more than 1,700 cars.[7]

In contrast to Europe, many cities in North America, especially in the United States, lack a good system of public transportation—a prerequisite for successful car-sharing. (Car-sharing is too expensive to use as a sole means of transport.) Still, car-sharing is growing rapidly in North America where conditions are favorable. One company operating in Boston and Washington, DC, saw membership grow more than sixfold between 2000 and 2001.[8] And older operations have proved successful in Montreal, Portland, San Francisco, Seattle, Toronto, and Vancouver.

Car-sharing carves out a niche for the automobile that plays to its greatest strength as a highly flexible transportation option that allows travel to any destination or combination of destinations, on demand, with the capacity to carry cargo or passengers. It operates on the assumption that other transport needs—from daily commuting to trips to the corner market—are best met by other modes, such as mass transit, cycling, or walking. By using a mix of transportation, car sharers tap the automobile's assets while minimizing the expense, inconvenience, and extensive environmental toll of private ownership.

Owners of private cars have a strong economic incentive to drive rather than bus, cycle, or walk because of the heavy investment already made in their automobile and because the cost per trip of driving is relatively low.[9] But when car-sharing replaces private ownership, this incentive disappears, and people pay more attention to their cost per trip. Ironically, people who become car sharers often use the shared cars less and less over time as they become more aware of the relative costs of driving versus using mass transit, cycling, and walking.[10] Car sharers who previously did not own an automobile not surprisingly end up driving more, but they still travel less and use less fuel than a private owner.[11]

For people who can forgo a car for daily use, car-sharing can lower total transportation expenses. The American Automobile

Table 1: Car-Sharing Members and Vehicles, by Region, 2001

Region	Members	Vehicles
	(number)	
Europe	112,701	4,865
North America	11,032	547
Asia	1,850	70
Total	125,583	5,482

Source: Worldwatch estimates based on discussions with various car-sharing organizations.

Association estimates that car ownership costs on average $7,600 per year in the United States for a car driven 24,000 kilometers (15,000 miles) annually.[12] People using a shared car for 16 hours a month, driving 128 kilometers (80 miles), would spend only $1,900 as members of a Washington, DC, CSO—a savings of $5,700 a year in driving expenses.[13] Even if they spend another $1,500 on mass transit, they can expect to save more than $4,000 annually.

Car-sharing is a good example of using services, rather than goods, to meet people's economic needs. In this case, subscribers rely on the service provided by a CSO rather than a private car to meet part of their transportation needs. This trend toward services reduces environmental impact by making the economy less materials-intensive. Indeed, each shared car is estimated to eliminate four cars—and all the rubber, metal, and glass that these represent—from the road.[14]

Because car sharers drive less than most car owners do, car-sharing brings real social and environmental benefits to cities. In Switzerland, people who give up their car when they join a CSO reduce car use by more than 70 percent a year, easing congestion and pollution.[15] And compared with nonmembers, subscribers to the Mobility CSO in Switzerland use about 55 percent less fuel annually.[16] Yet they are not socially isolated: they end up travelling about 10 percent more a year than before they started car-sharing—via mass transit, bicycle, motorbike, or walking.[17] And because shared cars are used more intensively than privately owned vehicles (which typically sit idle most of the time), sharing reduces the need for parking spaces.

Some European car-sharing agencies have begun to link car-sharing with other transportation options and with other car-sharing organizations. In 1998, Swiss Federal Railways and Mobility CarSharing Switzerland introduced a combined season pass that allowed access to shared cars and to trains throughout the country.[18] And European Car-Sharing, a consortium of these organizations, makes cars from its members available to subscribers in more than 80 cities across the continent.[19]

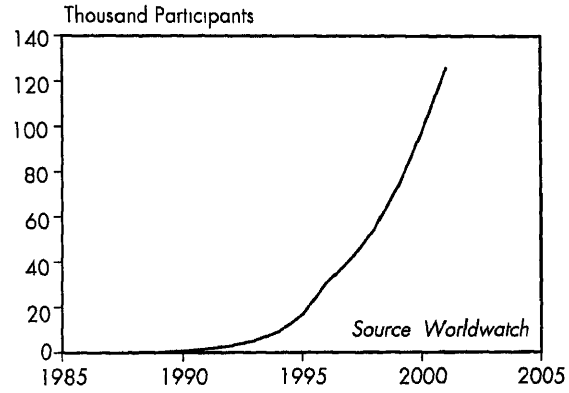

Figure 1. Growth in Car-Sharing Worldwide, 1988–2001

The future of car-sharing appears to be bright. In Switzerland, some 600,000 people—9 percent of the population, and 15 times the current car-sharing subscription base—are estimated to be interested in signing up.[20] Meanwhile, rental companies are jumping into the game. In May 2000, San Francisco's rapid transit authority and Hertz jointly launched a commercial "station car" rental program.[21]

Sprawling Cities Have Global Effects

Molly O Sheehan

Cars and highways are stretching cities to new limits, as cars require more space than other forms of urban transportation do A lane of light rail, for example, can move four to eight times more people per hour than a lane of highway can, while 10–20 bicycles can be parked in the space needed for one car [1]

Although there is no single global measure of car-dependent urban development, or "sprawl," census data do reveal more spread-out cities in some parts of the world— most dramatically in the United States [2] One analysis of U S census statistics found that the number of people living in 58 U S metropolitan areas rose 80 percent between 1950 and 1990, while the land covered by those areas expanded 305 percent [3] Another study found that even in 11 urbanized areas in the United States where population decreased between 1970 and 1990, the amount of land covered by those urbanized areas increased [4]

Links pp. 52, 74, 88, 150

Researchers trying to track urbanization patterns worldwide are thwarted by inaccurate or outdated census data, so satellite remote sensing has emerged as an important tool For example, Landsat images of Shenzhen in China reveal a rapid increase in built-up area 25 percent growth between 1992 and 1996 alone [5] One set of studies undertaken in the United States in the 1990s combined Landsat images with historical maps and census data to show land growth outpacing population growth in the San Francisco– Sacramento and Washington, DC–Baltimore regions [6] Scientists plan to use this approach for other cities [7]

Many cities are located on prime agricultural sites, so urban expansion paves over valuable farmland Researchers have used images from a U S satellite to create a map of nighttime city lights that corresponds well to census estimates of urban area [8] When researchers compared the area covered by cities to the U N Food and Agriculture Organization's digital soil map, they found that although only 3 percent of the U S land surface is urbanized, the best soils are being developed first [9] Suburban roads and houses supplant more than 1 million hectares of farmland each year in the United States [10] In China, the government estimates that some 200,000 hectares of arable land disappear each year under city streets and developments [11]

Sprawl is also linked to global climate change Carbon dioxide, released in large quantities by fossil fuel combustion, is one of the most important heat-trapping "greenhouse gases" warming the atmosphere [12] Between 1990 and 1998, road transportation was the fastest growing source of carbon emissions from fuel burning [13] (See Figure 1) Researchers studying transportation and land use in cities worldwide find higher carbon emissions per person in less densely populated, sprawling urban areas [14] (See Figure 2)

If average temperatures continue to rise as scientists project, the consequences are likely to include sea level rise, deadly heat waves, and an expanded range for disease vectors—and most cities will be vulnerable to one or more of these threats [15] Many cities are located along coasts, which are most endangered by sea level rise Indeed, two thirds of the world's population lives within 60 kilometers of a coast, and this number is expected to rise to three fourths by 2010 [16] Even a small hike in average temperature can increase the risk of heat waves, which can be especially deadly in cities because

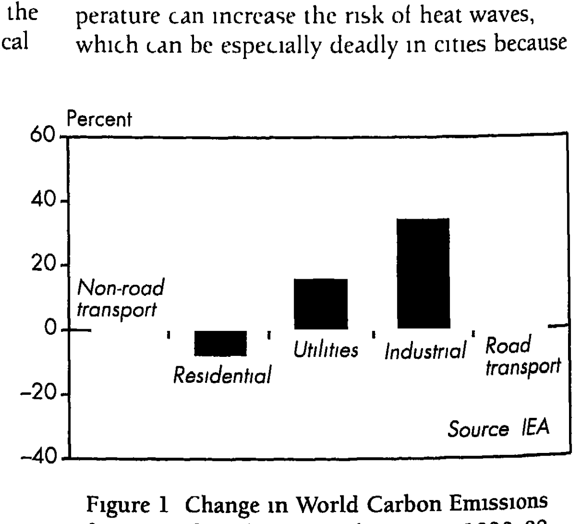

Figure 1 Change in World Carbon Emissions from Fossil Fuel Burning, by Sector, 1990–98

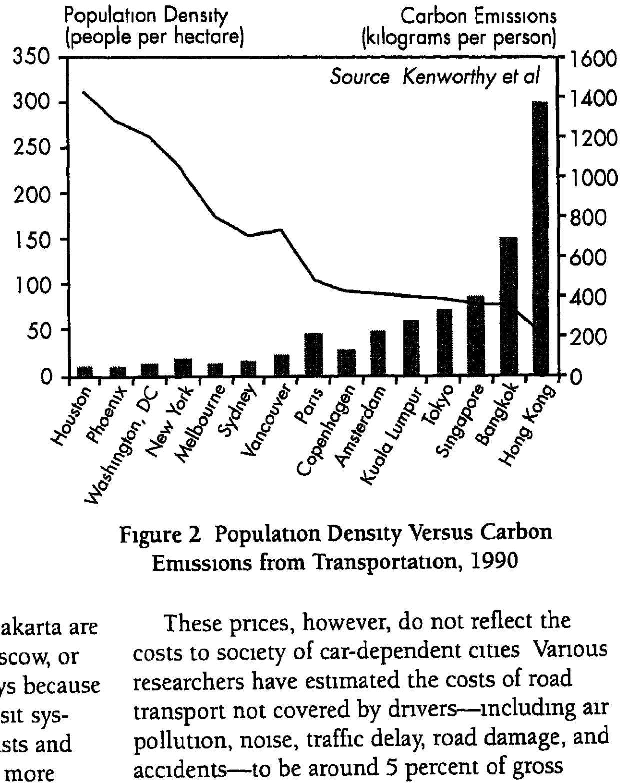

Figure 2 Population Density Versus Carbon Emissions from Transportation, 1990

hot weather accelerates the chemical reactions that produce urban smog[17]

Perhaps the most important global implication of sprawl, however, is that more of the world's people are experiencing the local health effects of car-centered development, including air pollution and road deaths Studies in Europe show that in some countries pollution from motor vehicles actually kills more people than vehicle accidents do[18] The death toll from vehicle accidents alone is not insignificant nearly a million people—mostly pedestrians—are killed on the world's roads each year[19]

Motor vehicles also harm human well-being by impeding other forms of traffic and causing costly delays Cities such as Atlanta, Bangkok, and Jakarta are less densely populated than Paris, Moscow, or Shanghai, yet suffer worse traffic delays because they have neither effective public transit systems nor adequate facilities for bicyclists and pedestrians[20] Every day Atlanta loses more than $6 million to traffic delays, and Bangkok more than $4 million[21] But such estimates only value hours that could have been spent working, it is harder to measure the loss to society of time that could have been used to care for children or build friendships in a community

Nearly half the world—2 8 billion people—lived in urban agglomerations in 1999, almost four times as many as in 1950[22] And that number is projected to rise significantly The way cities are built directly affects the lives of many more people today than in years past, and will likely continue to do so in the decades to come

Although the situation varies from country to country, economic forces tend to favor sprawl the price of construction falls with distance from city centers, the up-front price of building a road network is far less than investing in a public transit system, and the price of any given car trip in many cities is less than that of bus or rail travel[23]

These prices, however, do not reflect the costs to society of car-dependent cities Various researchers have estimated the costs of road transport not covered by drivers—including air pollution, noise, traffic delay, road damage, and accidents—to be around 5 percent of gross domestic product in industrial countries such as the United States, and even higher in some developing-country cities[24]

Governments could alter price signals that favor sprawl by minimizing their spending on new roads, sewers, and other infrastructure in outlying areas, by removing barriers to investment in central locations, and by adjusting the taxes of various transportation modes Bicycling imposes few costs to society, so in countries where a bicycle constitutes a serious investment, governments could slash the luxury tax on bikes and help lower the barriers to purchase by underwriting loans[25] Governments could also increase the price of driving by raising motor fuel taxes, charging heavy trucks for the extra wear they impose on roads, introducing fees for driving on congested roads at peak travel times, and substituting transit tickets for parking privileges[26]

Teacher Shortages Hit Hard

Kathleen Huvane

The world will require more than 18 million additional teachers in the coming decade if it is to reach universal primary education goals by 2015.[1] Teacher shortages persist in a variety of forms and regions (see Figure 1) that have disparate impacts—affecting access, duration, and quality of schooling for children.[2]

Generalizations sometimes mask inequities within nations as well. The richest 10 percent of El Salvador's youth, for instance, receive 8.6 more years of schooling than the poorest 10 percent, indicating an acute lack of teachers for the most needy.[3] Persistent shortages plague remote rural and low-income urban areas of the United States, where turnover rates are highest and the greatest percentage of teachers are uncertified, especially in schools with a high proportion of non-Caucasian students.[4] Seventy percent of American schools with "low minority" populations have math teachers with a degree in math, compared with just 42 percent in "high minority" schools.[5]

Links: pp. 88, 90, 148

Mortality from AIDS has reduced populations of both students and teachers throughout sub-Saharan Africa.[6] By 2010, for example, Zimbabwe's primary school population will likely decline by 24 percent.[7] And eight teachers die every week in Côte d'Ivoire from AIDS-related illness.[8] All employment sectors have been affected by AIDS, and many teachers have left the profession to fill gaps left in more lucrative professions.[9]

The dearth of trained teaching professionals reinforces the cycle of underenrollment. One third of all children in developing countries attend school for less than five years.[10] Although student enrollment has increased in every region of the world since 1990, more than one quarter of the children in South Asia and 40 percent of all children in Africa did not have access to a formal education in 1998.[11]

Many highly qualified teachers from developing countries are being recruited to fill positions in U.S. and European schools.[12] In 2001, teachers from such countries as Barbados and Jamaica were recruited by New York City public schools to address an 8,000-person teacher shortage.[13] Lured by salaries up to four times higher than in their home countries, these teachers are often some of the most educated and fluent English speakers in their fields.

Salaries, the single largest expenditure for schools, determine the number of teachers that can be hired. As public resources diminish, parents and other supporters have to pay more for schooling. Some 40 percent of education funding in Chile, Peru, and the Philippines comes from private sources, and Oxfam estimates that the poorest 40 percent of developing-country families will spend one tenth of their income to send two children to primary school.[14]

Education spending is often curtailed in countries undergoing economic transition or crisis. Economic reforms in Zambia outlined by the International Monetary Fund in 1991 led to a 25-percent reduction in education spending in just three years.[15] Private-sector growth in education systems is encouraged in developing countries like Côte d'Ivoire, where 60 percent

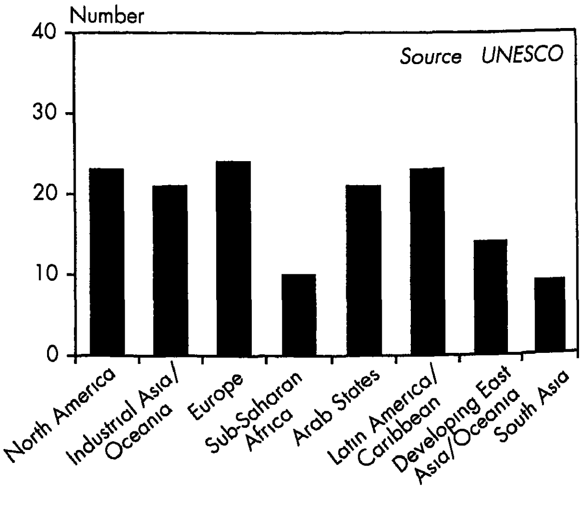

Figure 1 Teachers per Thousand Population, by Region, 1997

of secondary schools have been privatized—a trend that can exacerbate inequities as the poorest, especially girls, are excluded.[16]

Teacher shortages in industrial countries are exacerbated during times of economic growth because existing and potential teachers are drawn to higher-paying jobs. Ironically, recent downturns in the global economy may have a positive impact on the teacher supply: in California's Silicon Valley, shortages have diminished since the technology economy crashed in 2000.[17]

When scarcities intensify, teachers are assigned to positions for which they are not adequately trained. Half of California's new schoolteachers in 2000, for example, had either no credentials or were inadequately prepared for the subjects they taught.[18] Sub-par test scores in Germany have been partly attributed to low teacher morale and shortages in certain subject areas.[19]

Training and supporting new teachers can be costly, and returns from these investments are often never realized. For instance, half of all new teachers in city schools in the United States quit within five years.[20] Nearly half of Australia's teacher population is over 45, and the number of university students in education programs there fell by 33 percent between 1991 and 1998.[21] A third of Germany's teachers reportedly feel overworked, and two thirds retire early.[22]

Children in industrial countries spend more time in school and benefit from smaller class sizes. In contrast, compulsory education in Colombia and Nepal lasts just five years—half as long as in France and Australia.[23] Student-teacher ratios vary widely across the world, from a low of 1:8 in Libya to a high of 1:72 in Mali.[24] The typical primary school teacher in the Democratic Republic of Congo in 1995 had 24 more pupils in his or her class than a teacher in Spain, a gap indicative of regional trends.[25]

A shortfall of qualified teachers in math, science, special education, and bilingual education afflicts schools in the United States and many European countries.[26] Such problems also exist in developing countries, where less than 1 percent of children with special needs attend school, but they are often overshadowed by more pressing educational crises.[27] Some governments are under pressure to find enough teachers to meet the demands of demographic "youth bulges." Half the population of Egypt, Iran, Iraq, Saudi Arabia, and Syria is under 25, while over 60 percent of Pakistan and Afghanistan's populations fall into that category.[28]

Teacher shortages are also a result of national disasters and conflict. Some 80 percent of children not enrolled in school live in crisis or post-crisis countries, where the teaching staff who remain are commonly undertrained and underpaid.[29] Teachers have even been specifically targeted for political killings by regimes such as the Khmer Rouge, which decimated Cambodia's teacher population in the 1970s—a loss from which it has yet to recover.[30]

A lack of teachers with diverse cultural and ethnic backgrounds constitutes another type of shortage, as students are deprived of role models and perspectives from their own communities. Over a third of all U.S. students are minorities, but 87 percent of the teachers are Caucasian.[31] Teacher shortages can also be gender-based. Countries with low female literacy and enrollment rates are also likely to have lower percentages of female teachers.[32] Though women dominate the teaching profession globally, they are rare in remote rural areas of developing countries.[33]

Free and compulsory education is identified as a fundamental human right by the United Nations.[34] It can elevate living standards for individuals and societies as a whole, with positive impacts measured across a broad range of economic and social indicators, including increased gender equity, improved health, higher incomes, and lower levels of population growth. While effective education can take many forms, there is little dispute about the fact that a skilled teaching force is central to the actualization of this commitment.

Women Subject to Violence

Danielle Nierenberg

One in three women worldwide has experienced abuse in her lifetime [1] And in some nations, according to the World Health Organization, the number of women ever abused ranges from 16 to 52 percent [2] Abuse from an intimate partner—the most common form of violence against women—occurs in all countries, transcending economic, cultural, and religious boundaries [3] But these numbers are only estimates at best—the shame, fear, and lack of legal rights that accompany gender inequality keep many women from reporting their attackers or even acknowledging that abuse is a problem throughout their lives

Abuse shadows women from birth—and even before [4] (See Table 1) Sex-selective abortions, female infanticide, and neglect of girl children are common in India, China, and other nations UNICEF estimates that more than 60 million girls worldwide are considered "missing" because they were aborted, killed shortly after birth, or hidden from authorities [5] In the Indian state of Haryana, the sex ratio has increasingly favored males since the early 1990s—160 males are born for every 100 females [6] China's most recent census shows that 117 boys are born for every 100 girls, and in the most remote regions the difference is even higher[7] By comparison, in Germany usually 96 boys are born for every 100 girls [8]

Links: pp 88, 94, 144, 148

As children and adolescents, girls experience such familial, educational, and cultural abuses as enforced malnutrition, incest, female genital mutilation (FGM), denial of medical care, early marriage, prostitution, and forced labor[9] An estimated 140 million women and girls have undergone debilitating mutilation of their genitals, and another 2 million are at risk of being subjected to this practice each year because of their ethnic or religious backgrounds [10] FGM causes its victims to suffer a lifetime of painful urination, menstruation, and sexual intercourse, as well as difficulties during childbirth It also increases women's vulnerability to HIV/AIDS and other sexually transmitted diseases due to the use and reuse of unsanitary instruments [11]

According to the U S Department of Justice, young women—teenagers to women in their mid-twenties—are nearly three time as vulnerable as older women to attack by a husband, boyfriend, or former partner [12] But older victims of domestic violence—those between 35 and 49 years of age—are more likely than younger ones to be killed [13] Overall, women in the United States are 60 percent more likely than men to be killed by an intimate partner [14]

Violence against women often includes more than physical or verbal assaults A third to half of physically abused women also report forced sex [15] In fact, a study in Leon, Nicaragua, found that only 2 5 percent of women abused by their partners had *not* been sexually assaulted [16] Used as a weapon, sexual violence in all its forms—coerced sex, rape, incest—inhibits women's ability to control their own reproductive health Women in conflict situations are particularly vulnerable when rape is used as tool of intimidation During the war in the Balkans, between 20,000 and 50,000 women and girls were raped in Bosnia-Herzegovina [17]

Children, and especially girls, suffer from domestic violence as well According to UNICEF, almost two thirds of the children who live in families where the mother is abused by a husband or boyfriend are also beaten [18] Children of women who are beaten by their domestic partners are more likely than other children to die before the age of 5 [19]

"Too often, women and girls cannot say no to unwanted and unprotected sex without fear of reprisal," notes Noeleen Heyzer, Executive Director of UNIFEM, the U N Development Fund for Women [20] Many men consider sex their unconditional right, and fear often prevents women from discussing contraceptives or their sexual rights with partners UNICEF reports that women in Kenya and Zimbabwe hide their birth control pills in fear that their husbands will discover that "they no longer control their wives' fertility"[21] Forced sexual initiation also increases the risk of HIV infection among girls and women More than two thirds of girls in South Africa do not choose to have sex the first time but are instead coerced

Table 1. Selected Examples of Violence Against Women

Female Infanticide	In Punjab, India, only 793 girls were born for every 1,000 boys.
Female Genital Mutilation	In Ethiopia, nearly 85 percent of girls have undergone mutilation of their genitalia; in Somalia, the figure is more than 95 percent. Worldwide, more than 6,000 girls per day are in danger of undergoing these procedures due to their ethnic or religious backgrounds.
Rape	In the United States, 1.5 million women are raped annually and 14–20 percent of women will be raped in their lifetimes.
Murders	In India, more than 5,000 brides are killed annually because their families are unable or unwilling to pay the dowry promised at marriage.
Honor Killings	As many as 5,000 young women died at the hands of their parents or other relatives in 2000 for "shaming" their families by having sex, socializing with boys, or becoming victims of rape.
Suicides	In China, suicide is the leading cause of death for women between the ages of 20 and 34.

Source: See endnote 4.

and raped, increasing their chances of contracting AIDS in a nation where 10 percent of the population is HIV-positive.[22]

Poverty can exacerbate abuse, exploitation, and violence against women. An estimated 4 million women and girls are bought and sold worldwide each year.[23] Traffickers target economically depressed families, promising to find work and schooling for their daughters in the city. Most of these young women and girls then become prostitutes: at least 10,000 enter the commercial sex trade in Thailand each year, and roughly 7,000 Nepali girls are brought into India annually for prostitution.[24]

Ironically, increasing women's economic participation can contribute to a sense of inadequacy among men, leading them to use violence as a means of "control." In addition to being beaten, *maquiladora* workers in Mexico report being deprived of their earnings by their husbands, as do women in microcredit programs in parts of Peru and Bangladesh.[25] In Papua New Guinea, the main reason female teachers gave for turning down promotions was "the fear that it would provoke their husbands to more violence."[26]

In extreme cases, women may try to end their lives to escape abuse. According to Radhika Coomaraswamy, the U.N. envoy on violence against women, "the suicide rate among women is high in conservative and repressive societies."[27] Under restrictive religious regimes, "some women see suicide as the only way out."[28] Females in some parts of Turkey, Afghanistan, and Iran account for as much as 80 percent of all suicides.[29] Nearly 500 women a day kill themselves in China alone.[30]

In 1995, the Fourth World Conference on Women in Beijing gave priority to eradicating violence against women—calling it an "obstacle to the achievement of the objectives of equality, development and peace."[31] An end to the violence requires an end to the discrimination that women face in every aspect of their lives—from inequities in education and the workplace to the lack of control they have over their sexual and reproductive lives.

Voter Participation Declines

Molly O. Sheehan

Voter participation in competitive elections worldwide declined slightly between 1945 and 1979, from an average of 78 percent to 76 percent, and then rose to 79 percent in the 1980s, according to the Stockholm-based International Institute for Democracy and Electoral Assistance (IDEA).[1] But overall turnout at elections dipped to 71 percent in the 1990s.[2] (See Figure 1.)

Several factors help to explain the drop-off. Since the 1970s, voter participation in many established democracies has declined gradually.[3] Many nations of the developing world that have introduced elections since the 1960s have young populations, and youth in all nations tend to vote less than their elders do.[4] Also, there was a sharp rise in the total number of elections in the 1990s, which was spurred by the newly democratizing nations of the former Soviet bloc. These countries registered relatively low voter turnout on average, although their participation levels are increasing with time.[5] Whereas there were some 294 presidential and parliamentary elections in the 1980s, there were 603 such elections in the 1990s.[6]

Despite the dip, voters have turned out in force in a wide range of nations all across the world since 1945.[7] (See Table 1.) The elections with the best turnouts since 2000 similarly have occurred in a cross-section of nations: more than 90 percent of eligible voters participated in parliamentary elections in Ethiopia, Tajikistan, and Guyana in 2000 and in presidential elections in Chile in 2000 and Seychelles in 2001.[8] Five of the top democracies in voter turnout—Australia, Belgium, Liechtenstein, Nauru, and Singapore—enforce compulsory voting laws, which could help explain their high participation rates.[9] There is no significant correlation between a nation's voter turnout and its wealth, the number of years it has been a democracy, or its literacy level.[10]

Although the existence of elections does not guarantee a high quality of life, the 86 electoral democracies that receive the highest ranking of "free" by the independent monitoring group Freedom House are also the most prosperous.[11] This organization finds that the share of world population living in "free" democratic states grew from 36 percent in 1981 to 41 percent in 2001.[12] The worst nations in this ranking are Afghanistan, Cuba, Equatorial Guinea, Iraq, Libya, Myanmar (formerly Burma), North Korea, Saudi Arabia, Sudan, Syria, and Turkmenistan.[13]

Despite the promise of a host of first-ever democratic elections in Eastern Europe and Central Asia in the 1990s, several nations in these regions saw progress toward free and fair elections erode. The March 2000 presidential elections in Russia suffered from heavy government pressure on the press, voter fraud marred the November 2000 elections in Azerbaijan, and the government of the Ukraine has increasingly interfered in press coverage of public affairs.[14]

Today, 21 of 53 nations in Africa are electoral democracies, more than ever before, but corruption continues to mar many campaigns and elections in this region.[15] Reports of political killings overshadowed Zimbabwe's 2002 presidential campaign, as the government led by President Robert Mugabe cracked down on the media and intimidated opponents.[16] Despair over entrenched government graft

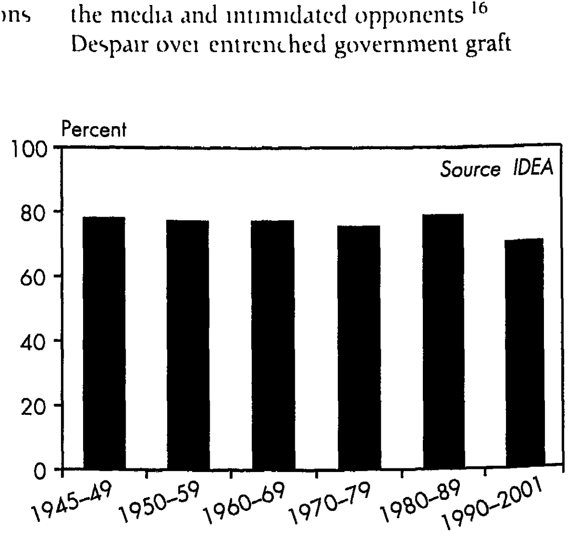

Figure 1. Voter Turnout in Elections, 1945–2001

Table 1. Top 15 Nations in Voter Participation, 1945–2001

Country	Elections (number)	Average Share of Voters Participating in National Elections (percent)
Australia	22	94.5
Singapore	8	93.5
Uzbekistan	3	93.5
Liechtenstein	17	92.8
Belgium	18	92.5
Nauru	5	92.4
Bahamas	6	91.9
Indonesia	7	91.5
Burundi	1	91.4
Austria	17	91.3
Angola	1	91.2
Mongolia	4	91.1
New Zealand	19	90.8
Cambodia	2	90.3
Italy	15	89.8

Source: See endnote 7.

appeared to be at least one of the factors contributing to violence in Kenya's slums in the run-up to that nation's 2002 election.[17]

On a more positive note, a number of elections since 2000 have served to further peace and human rights. In Ghana, a president who seized power in a 1981 coup and ruled for nearly two decades was prevented from continuing for a third term by the nation's constitution. The nation held its first-ever democratic elections in 2000, in which more than 60 percent of the voting population turned out to elect opposition leader John Kufour as president.[18]

After years of bloodshed in Yugoslavia under Slobodan Milosevic, the free election of Vojislav Kostunica in 2000 heralded a new era.[19] Similarly, in the province of Kosovo, the first-ever democratic elections were held in 2000.[20]

In Mexico, the election of Vicente Fox in 2000 ended more than 70 years of virtual one-party government.[21] The resignation of Alberto Fujimori in Peru amidst a corruption scandal was followed by gains in political freedom and the fair election of Alejandro Toledo in 2001.[22]

Some 86 percent of voters turned out to participate in the first democratic election in East Timor in 2001.[23] The elections created a new parliament two years after East Timor voted to affirm its independence from Indonesia.[24] And in February 2001, some 90 percent of registered voters in Bahrain turned out to support a referendum to establish a democratically elected chamber in parliament and to set up an independent judiciary.[25]

Some more established democracies held elections with record low turnouts in recent years. The U.S. presidential election of 2000 attracted only 51 percent of eligible voters, although it received worldwide attention as a result of the debate over the counting of ballots in the closely contested race.[26] The United Kingdom also had a record low turnout for its parliamentary elections in 2001, with only 59 percent of eligible voters participating.[27]

In countries that hold competitive elections, advocates of environmental protection and social justice have the opportunity to raise the profile of these issues at the ballot box. In Western Europe, strong, pro-environment "green" political parties have pushed environmental issues onto the public agenda in many nations.[28] And as urban sprawl has emerged as a growing concern in the United States, voters approved hundreds of local and state ballot initiatives to address the problem in the 1998 and 2000 elections.[29]

Military Features

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Progress Against Landmines

Progress Against Landmines

Michael Renner

Anti-personnel landmines have taken a heavy toll for decades [1] Not only do they kill and maim indiscriminately, they make fertile land unusable, inhibit travel, prevent farmers from getting their produce to markets, discourage repatriation of refugees, and hinder reconstruction efforts after wars end

Since the passage of the international mine ban treaty in 1999, however, significant headway has been made in recent years in battling this problem [2] A growing number of governments are joining the treaty And the International Campaign to Ban Landmines (ICBL), an international coalition of nongovernmental organizations, concludes that there is reduced use of anti-personnel mines, a dramatic drop in their production, a near-complete halt to exports, destruction of stockpiled mines at a rapid pace, growing amounts of land that has been cleared of mines, and fewer victims in affected countries [3]

Link p 94

The Mine Ban Treaty was hammered out in just 14 months, opened for signature in December 1997, and entered into force in March 1999—lightning speed compared with the usual process of international negotiating and treaty-making [4] Its adoption capped a highly successful campaign by the ICBL, which started in 1992 [5]

As of October 2001, 142 countries had signed or ratified the treaty[6] Almost all African countries, heavily affected by mines, have signed on In the western hemisphere, only the United States and Cuba have not joined in, in the European Union, only Finland has not Most of the Middle East and many Asian nations have so far declined to join the treaty Unfortunately, the 53 holdouts around the world include three of the five permanent members of the Security Council (the United States, Russia, and China) and some other major producers, including India and Pakistan [7]

In its 2001 *Landmine Monitor* report, the ICBL puts the number of countries still producing anti-personnel mines at 14, among them Russia, Egypt, Iran, Iraq, China, India, Pakistan, North Korea, and South Korea [8] The United States is included in this category as well, although it has not manufactured any mines since 1996, it has refused to adopt an official moratorium or ban [9] Encouragingly, 41 nations have now ended production, including 8 of the 12 major past producers, all of them in Europe [10]

The ICBL estimates that about 230–245 million anti-personnel mines remain stockpiled in 100 countries [11] Non-signatories to the treaty hold the vast majority—some 215–225 million [12] China alone is believed to have 110 million mines, followed by Russia with 60–70 million, and the United States with 11 million [13] Ukraine, Pakistan, India, and Belarus each hold about 4–6 million [14] The treaty requires that stockpiles be eliminated, and some 27 million anti-personnel mines have been destroyed in recent years in as many as 50 countries [15] By late 2001, 28 countries had destroyed their arsenals, and another 19 are well along in this task [16]

The U S State Department estimates that there are 45–50 million landmines buried in nearly 60 countries [17] But *Landmine Monitor 2001* reports that 90 countries and 11 non-sovereign territories (such as Chechnya, Iraqi Kurdistan, Palestine, and Somaliland) are affected [18] Only about one third of them have undertaken surveys or undergone a systematic assessment [19] During 2000 and early 2001, mine clearance operations were carried out in 76 countries and territories [20]

No one knows how many people fall victim to mines each year The tally from reported incidents in 2000 was somewhat less than 10,000 casualties [21] But a significant number of incidents are believed to go unreported The ICBL estimates that mine explosions kill or maim 15,000–20,000 persons annually[22] While this is still a very large number, it is down from earlier estimates of 26,000–30,000 casualties [23] Landmines continue to be a danger long after a conflict comes to an end, most casualties occurred in countries no longer at war [24]

More than $1 billion has been made available for demining activities during the past decade [25] Though tracking available money is difficult, the ICBL puts spending in 2000 at $224 million [26] The amounts available have increased, but the United Nations judges available resources still too limited to meet the needs of affected countries [27] The leading funders are the United States, Norway, the United Kingdom, Sweden, Germany, and Japan [28] By the end of 2001, the United States had provided more than $500 million in demining assistance to 40 countries [29] The bulk of funds went to Afghanistan, Angola, Bosnia, Cambodia, and Mozambique [30]

Afghanistan has been heavily mined since the late 1970s The upsurge in fighting that accompanied the U S air campaign against the Taliban regime and Al Qaeda forces in late 2001 added unknown quantities of unexploded ammunitions to the demining challenge [31] Just how many mines are scattered was unknown even before the most recent turn of events The U S State Department estimates them at 4 million (see Table 1), down from its 1998 estimate of 10 million [32] Some observers insist the number is 1 million or less, whereas the U S Campaign to Ban Landmines uses an estimate of 8–10 million [33]

In Afghanistan, some 723 square kilometers have been found to be mine-infested, but additional mined areas are being detected at the rate of 12–14 square kilometers a year [34] Mines have severely reduced the amount of Afghan agricultural and grazing land safely accessible The U N Development Programme and the World Bank estimate that at current funding levels, it will take 7–10 years to clear roughly half of the contaminated areas, some 344 square kilometers of the most productive land, which would allow most Afghans to resume a more normal life [35]

In 2000, there were more than 1,000 recorded mine casualties in Afghanistan, down from more than 7,200 in 1993 [36] But the real number could easily be 50–100 percent larger [37] Indeed, a State Department estimate uses a figure of 2,400 [38] And the Organization for Mine Clearance and Afghan Rehabilitation, a U N -sponsored agency, believes annual casualties to be as high as 4,000 [39]

The populations of many mine-affected countries will likely confront the dangers and uncertainties of mines for decades, if not centuries A recent assessment of Cambodia's situation concluded that landmine clearance may take 200–300 years at current removal rates [40]

Table 1: Estimated Effect of Anti-Personnel Landmines, Selected Countries, 2000

Country	Number of Landmines	Land Area Affected (square kilometers)	Share of Territory (percent)	Landmine Victims, 2000
Afghanistan	4 million	723	0 1	2,400
Angola	200,000–6 million	634,547	50 9	840
Armenia	100,000	2,500	8 0	8
Bosnia-Herzegovina	1 million	4,200	8 2	87
Cambodia	300,00–1 million	2,000	1 1	811
Colombia	70,000	248,216	21 8	n a
Croatia	1–1 2 million	4,000	7 1	22
Egypt	5–7 5 million	2,800	0 2	n a
Ethiopia	1 5–2 million	2,000	0 2	15
Viet Nam	3 5 million	n a	n a	2,000

Source U S Department of State, *To Walk the Earth in Safety The United States Commitment to Humanitarian Demining* (Washington, DC November 2001), Worldwatch calculations

Notes

AQUACULTURE PRODUCTION INTENSIFIES (pages 24–25)

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2. Adele Crispoldi, U N Fisheries Department, Fishery Information, Data, and Statistics Service, e-mail to author, 21 January 2002
3. "Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000," in Rohana P Subasinghe et al, eds, *Aquaculture in the Third Millennium Technical Proceedings of the Conference on Aquaculture* (Bangkok Network of Aquaculture Centres in Asia-Pacific and FAO, 2000), p 463
4. "Chapter 7 Fisheries," in FAO, *Agriculture Toward 2015/30*, technical interim report (Rome 2001), p 172
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6. "Chapter 7," op cit note 4, p 173
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9. Crispoldi, op cit note 2, Reg Watson and Daniel Pauly, "Systematic Distortions in World Fisheries Catch Trends," *Nature*, 29 November 2001, pp 534–36
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THE VITAL SIGNS SERIES

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- Arms and Grain Trade (1992)
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- Fossil Fuel Subsidies (1998)
- ♦ Gold (1994, 2000)
- Metals Exploration (1998, ♦2002)
- ♦ Metals Production (2002)
- ♦ Paper (1993, 1994, 1998–2000)
- Paper Recycling (1994, 1998, 2000)
- ♦ Roundwood (1994, 1997, 1999, 2002)
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- ♦ Steel (1993, 1996)
- Steel Recycling (1992, 1995)
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- Wheat/Oil Exchange Rate (1992–93, 2001)

World Economy and Finance
- ♦ Agricultural Trade (2001)
- Aid for Sustainable Development (1997, 2002)
- ♦ Developing-Country Debt (1992–95, 1999–2002)
- Environmental Taxes (1996, 1998, 2000)
- Food Aid (1997)
- ♦ Global Economy (1992–2002)
- Microcredit (2001)
- ♦ Oil Spills (2002)

- Private Finance in Third World (1996, 1998)
- R&D Expenditures (1997)
- Socially Responsible Investing (2001)
- Stock Markets (2001)
- ◆ Trade (1993–96, 1998–2000, 2002)
- Transnational Corporations (1999–2000)
- ◆ U N Finances (1998–99, 2001)

Other Economic Topics

- ◆ Advertising (1993, 1999)
- Charitable Donations (2002)
- Cigarette Taxes (1993, 1995, 1998)
- Ecolabeling (2002)
- Government Corruption (1999)
- Health Care Spending (2001)
- Pharmaceutical Industry (2001)
- PVC Plastic (2001)
- Satellite Monitoring (2000)
- ◆ Storm Damages (1996–2001)
- ◆ Television (1995)

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Atmosphere

- ◆ Carbon Emissions (1992, 1994–2002)
- ◆ CFC Production (1992–96, 1998, 2002)
- ◆ Global Temperature (1992–2002)

Fossil Fuels

- ◆ Carbon Use (1993)
- ◆ Coal (1993–96, 1998)
- ◆ Fossil Fuels Combined (1997, 1999–2002)
- ◆ Natural Gas (1992, 1994–96, 1998)
- ◆ Oil (1992–96, 1998)

Renewables, Efficiency, Other Sources

- ◆ Compact Fluorescent Lamps (1993–96, 1998–2000, 2002)
- ◆ Efficiency (1992)
- ◆ Geothermal Power (1993, 1997)
- ◆ Hydroelectric Power (1993, 1998)
- ◆ Nuclear Power (1992–2002)
- ◆ Solar Cells (1992–2002)
- ◆ Wind Power (1992–2002)

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Animals

- Amphibians (1995, 2000)
- Aquatic Species (1996, 2002)
- Birds (1992, 1994, 2001)
- Marine Mammals (1993)
- Primates (1997)
- Vertebrates (1998)

Natural Resource Status

- Coral Reefs (1994, 2001)
- Farmland Quality (2002)
- Forests (1992, 1994–98, 2002)
- Groundwater Quality (2000)
- Ice Melting (2000)
- Ozone Layer (1997)
- Water Scarcity (1993, 2001–02)
- Water Tables (1995, 2000)
- Wetlands (2001)

Natural Resource Uses

- Biomass Energy (1999)
- Dams (1995)
- Ecosystem Conversion (1997)
- Energy Productivity (1994)
- Organic Waste Reuse (1998)
- Soil Erosion (1992, 1995)
- Tree Plantations (1998)

Pollution

- Acid Rain (1998)
- Algal Blooms (1999)
- Forest Damage from Air Pollution (1993)
- Lead in Gasoline (1995)
- Nuclear Waste (1992, ◆1995)
- Pesticide Resistance (◆1994, 1999)
- ◆ Sulfur and Nitrogen Emissions (1994–97)
- Urban Air Pollution (1999)

Other Environmental Topics

- Environmental Treaties (◆1995, 1996, 2000, 2002)
- Nitrogen Fixation (1998)
- Pollution Control Markets (1998)
- Semiconductor Impacts (2002)
- Transboundary Parks (2002)

THE MILITARY

- ♦ Armed Forces (1997)
- Arms Production (1997)
- ♦ Arms Trade (1994)
- Landmines (1996, 2002)
- ♦ Military Expenditures (1992, 1998)
- ♦ Nuclear Arsenal (1992–96, 1999, 2001)
- Peacekeeping Expenditures (1993, ♦1994–2002)
- ♦ Wars (1995, 1998–2002)
- Small Arms (1998–99)

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Health

- ♦ AIDS/HIV Incidence (1994–2002)
- Asthma (2002)
- Breast and Prostate Cancer (1995)
- ♦ Child Mortality (1993)
- ♦ Cigarettes (1992–2001)
- Drug Resistance (2001)
- Endocrine Disrupters (2000)
- Hunger (1995)
- ♦ Immunizations (1994)
- ♦ Infant Mortality (1992)
- Infectious Diseases (1996)
- Life Expectancy (1994, ♦1999)
- Malaria (2001)
- Malnutrition (1999)
- Noncommunicable Diseases (1997)
- Obesity (2001)
- ♦ Polio (1999)
- Safe Water Access (1995)
- Sanitation (1998)
- Soda Consumption (2002)
- Traffic Accidents (1994)
- Tuberculosis (2000)

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- Family Planning Access (1992)
- Female Education (1998)
- Fertility Rates (1993)
- Maternal Mortality (1992, 1997)
- ♦ Population Growth (1992–2002)
- Sperm Count (1999)
- Violence Against Women (1996, 2002)
- Women in Politics (1995, 2000)

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- Homelessness (1995)
- Income Distribution (1992, 1995, 1997, 2002)
- Language Extinction (1997, 2001)
- Literacy (1993, 2001)
- Prison Populations (2000)
- Social Security (2001)
- Teacher Supply (2002)
- Unemployment (1999)

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- Fast-Food Use (1999)
- Nongovernmental Organizations (1999)
- Refugees (♦1993–2000, 2001)
- Religious Environmentalism (2001)
- Urbanization (♦1995–96, ♦1998, ♦2000, 2002)
- Voter Turnouts (1996, 2002)
- Wind Energy Jobs (2000)

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- ♦ Air Travel (1993, 1999)
- ♦ Automobiles (1992–2002)
- ♦ Bicycles (1992–2002)
- Car-Sharing (2002)
- Computer Production and Use (1995)
- Gas Prices (2001)
- Electric Cars (1997)
- ♦ Internet (1998–2000, 2002)
- ♦ Motorbikes (1998)
- ♦ Railroads (2002)
- ♦ Satellites (1998–99)
- ♦ Telephones (1998–2000, 2002)
- ♦ Tourism (2000)
- Urban Transportation (1999, 2001)

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